AMERICAN CERAMIC SOCIETY

bulletin

emerging ceramics & glass technology

DECEMBER 2016
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Ceramic industry 2016 profile and manufacturing forecast

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by April Gocha, Stephanie Liverani, and Eileen De Guire

Ceramics Expo 2017 returns to Cleveland

Following rapid industry developments in various user segments, Ceramics Expo 2017 again will set the agenda as the progressive hub for the industry.

***ceramicSOURCE* 2017**

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Correction to the October/November issue of the *ACerS Bulletin*

"New silica dust regulations will require changes in workplaces," p. 32.

A correction was made to a unit error in the original publication—the new exposure limits are measured in $\mu g/m^3$, not g/m^3 as was originally printed. In addition, all instances of silica in this article refer to respirable crystalline silica. The archived electronic version has the correction.

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AMERICAN CERAMIC SOCIETY
bulletin

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news & trends

Ceramic and glass researchers seek 'Big Ideas' at NSF-funded workshop

To fulfill its mission, the National Science Foundation has to be focused and smart about how it spends its budget. The focus needs to be on science, and the "smart" has to be on emerging opportunities that will advance society in the long run.

According to the NSF's website, its $7.5 billion annual budget supports about one-fourth of basic science research conducted at United States-based universities and colleges through about 12,000 new awards per year.

That sounds like a lot of science, but the budget divides into seven research directorates and several "management and overhead" buckets. Thirty-two divisions reside under those seven research directorates, and those divisions break down further into discipline-specific programs.

The Directorate for Mathematical & Physical Sciences' Division of Materials Research (DMR)—which hosts the Ceramics Program—recently funded a workshop that looked into the minds of leading researchers in the U.S. and abroad.

Caltech professor Katherine Faber organized the two-and-a-half-day workshop to identify emerging opportunities in ceramics and glass science. She worked with an organizing committee of Jennifer Lewis (Harvard University), Clive Randall (Pennsylvania State University), and Greg Rohrer (Carnegie Mellon University). About 45 scientists presented the latest work in the field, challenges they are addressing, and, most importantly, why it matters in the context of scientific trends and society's compelling grand challenges.

Most attendees hailed from academia, although organizers were careful to balance experience levels. Perspectives from national laboratories and industry also were represented—the latter being especially important for providing "rubber meets the road" perspectives. Organizers also reached beyond the obvious community and invited experts outside the field working in "nearby" research areas, such as a mineral physicist and a solid-state chemist.

The first day-and-a-half comprised of

Credit: ACerS

Javier Garay (center, University of California, Riverside) fields a question during a panel discussion at a recent NSF workshop on emerging opportunities in ceramics and glass science. Also pictured are Gary Messing from Pennsylvania State University and Kathy Lu from Virginia Polytechnic Institute and State University.

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ACSBA7, Vol. 95, No. 9, pp 1–142. All feature articles are covered in Current Contents.

presentations arranged in five challenges:

• **Advanced processing.** Where can we go with advances in additive manufacturing? What new synthesis opportunities do polymer-derived ceramics offer? What does new science into low-temperature, pressurized sintering imply?

• **Defect-enabled phenomena.** What advantages do imperfect materials offer? Can "designer defects" lead to new functionality?

• **Low-dimensional phenomena.** Can properties of 2-D materials be tuned? Can we learn to process them with advanced methods, such as 3-D printing? Can surfaces be designed for catalysis, switching, or other functions?

• **Materials in extreme environments.** Extreme environments push materials to their critical property limits, including thermal, heat, or radiation flux and mechanical or electrical loads. How do we discover new materials for these environments and test and characterize them?

• **Glass and high-entropy materials.** What can we learn by better understanding and controlling amorphous structures? Do new approaches to achieving amorphicity open new ways of thinking about glass and its uses?

Topical sessions included panel discussions that generated lively conversation on a wide range of topics. Modeling techniques and strategies cut across all topics. In breakout sessions on the second day-and-a-half, participants worked on refining the definition of these areas and teasing out grand challenges and emerging opportunities.

Faber says, "The workshop has provided us with valuable assessments of where knowledge gaps exist in ceramic and glass science. These will form the basis of our emerging opportunities report and ultimately inspire researchers with a host of challenges to tackle." Putting it another way, Faber encouraged participants to seek "overarching ideas that provide a framework for individual contributions."

The output from the workshop will be an open-access article that will detail these opportunities, challenges that they present, and cross-cutting themes (for example, modeling and dataset management). Watch for that to publish in early 2017. ■

Business news

Microban secures patents for antimicrobial technology in ceramics (**microban.com**)…DOE announces $30M investment in hydrogen and fuel cells (**energy.gov**)…Faraday Future announces supply agreement with LG Chem (**ff.com**)…Morgan Advanced Materials develops alumina sensor to withstand extreme temperatures (**morganadvancedmaterials.com**)…Kyocera develops MLCCs with volumetric efficiency ideal for smartphones (global.kyocera.com)…Half of U.S. business R&D concentrated in five states (**nsf.gov**)…New NIST test bed provides all-in-one toolbox to explore digital manufacturing (**nist.gov**)…DOE invests $1.2M to advance national lab partnerships with manufacturing leaders (**energy.gov**)…Amedica announces 38% workforce reduction (**amedica.com**)…AGC glass furnace to go back into production at Boussois, France (**agc-glass.eu**)…RAK Ceramics launches new global brand identity (**rakceramics.com**)…Morgan Advanced Materials awarded £1.1M ballistic shields contract (**morgandefencesystems.com**)…Vitro completes acquisition of PPG's flat-glass business (**vitro.com**)…NREL report shows U.S. solar photovoltaic costs continuing to fall in 2016 (**nrel.gov**)…Alcoa Inc. board of directors approves separation of company (**alcoa.com**)…OLED on ceramic heralds new possibilities for durable, flexible lighting and displays (**holstcentre.com**)…AGC to release Dragontrail Pro, new specialty glass for chemical strengthening (**asahi-glass.com**)…NSF awards $94M to create four new Science and Technology Centers (**nsf.gov**)…Xaar 2001+ two-color printhead delivers production flexibility, reliability for tile manufacturers (**xaar.com**)…Pilot projects will bring MEP small-business expertise to Manufacturing USA institutes (**nist.gov**)…NASA iTech fosters technology needed for journey to Mars (**nasa.gov**)…PiBond develops new materials with high refractive index for optical applications (**pibond.com**)…glasstec 2016 generates important impulses: Good mood and solid investment climate (**glasstec-online.com**)…Air Products and NICE to work jointly on hydrogen fueling projects in China (**airproducts.com**). ■

Apple releases new iPhone 7 and ceramic Watch

Apple recently unveiled the latest iteration of its tech products, debuting the new iPhone 7 and Series 2 Watches.

And the rumors were true—the new iPhone 7 drastically ditched the headphone jack to make room for a stereo set of speakers to improve audio quality. New iPhone users now have to make the move to wireless headphones or use a lightning port headphone adapter.

As with virtually every other smartphone iteration, the new iPhone 7 also boasts a better-than-ever battery and an improved camera, including new dual wide angle and telephoto lenses on the iPhone 7 Plus.

The iPhone 7 has a new processor that runs twice as fast as the iPhone 6, and comes in a shiny new jet black finish as well as the more standard matte finishes.

But, its materials remain largely unchanged—the body case of the new phone is aluminum. So, as expected, consumers have to wait until next year to see if glass gets its chance in the iPhone 8.

Credit: Apple

The new Apple Watch Edition features a white ceramic case.

Apple, instead, made its big materials news this time around with the new Apple Watch Series 2—the special Edition version of the watch is now all-white and all-ceramic.

The new ceramic Edition watch replaces the previous expensive gold one—which contained ceramics in the gold mix—that started at a steep price of $10,000. The new all-ceramic Series 2 Edition, however, starts at just $1,249.

Although that remains a hefty price tag, it may be a relatively small price to pay for the peace of mind of not having to worry about scratches on the new smartwatch. Apple boasts that the alumina–zirconia ceramic in its new Watch is four times as hard as stainless steel, which many previous Apple Watch wearers have complained about because of its relative scratchability.

About a year ago, *Ceramic Tech Today* reported on Apple's patent for making harder ceramics.

That patent detailed the company's vacuum-based method for making ceramics from a slurry containing zirconia particles. Although it is not certain that the patent details the same process used to make the new ceramic Apple Watch, it does not seem like much of a stretch.

The patented method reduces porosity by using a vacuum to remove air bubbles from the ceramic slurry. Pores are a problem because they are one factor that can introduce weaknesses in the materials by serving as starting points for crack formation. So, removing bubbles in the slurry creates a harder ceramic.

According to the company, "The process of creating the Apple Watch Edition case begins with a high-strength zirconia powder that's combined with alumina to achieve its rich, white color. Each case then is compression molded, sintered, and polished using a diamond slurry, which results in a remarkably smooth surface and an exquisite shine."

Catch a glimpse of the latest releases in a short Apple preview video at youtu.be/GeoUELDgyM4. ■

ICG Summer School 2016 draws strong international turnout for intensive glass course

Editor's note: This story comes to us from the International Commission on Glass. For more information on ICG or its educational programs, contact J.M. Parker, University of Sheffield (U.K.) at j.m.parker@sheffield.ac.uk.

The 8th International Commission on Glass Summer School program took place in July in Montpellier, France, and it drew a strong turnout—36 participants from 10 countries gathered for the program's intensive glass course. Twenty-eight of those participants signed up for the glass science educational track and eight for glass technology.

The program combined formal lectures with student presentations, which gave participants a chance to share their research interests and aspirations. Students engaged in project work and tutorials and researched on site. Six of the lecturers arranged small group discussions to address student questions and topics of interest. Students also had the opportunity to network during various coffee breaks and lunches and during an opening welcome party and closing banquet.

On day one of the program, participants attended the same introductory courses, and the seven project groups included attendees from the glass science educational and glass technology tracks. Student feedback gathered during and after the program commented on friendliness of the lecturers and high quality of their teaching.

The last day of the program gave students the opportunity to demonstrate their lecturing skills and present conclusions on their projects in front of their peers. Final presentations also facilitated discussion and probing questions about research done during the course of the program.

Presentations were judged, and two first prizes were awarded: one to a group that examined mechanisms of sodium-ion diffusion and the involvement of nonbridging oxygen (Helene Pablo, Luka Pavic, Celine Ragoen, Alessio Zandona, and Abdul Rahshidi); and the other to a group tasked with creating a project for a

Credit: ICG

ICG Summer School 2016 participants get ready to dive into some serious glass research in Montpellier, France, in July.

final year undergraduate student on glass melting (Vickie Falk Jensen, Miroslava Huyjova, So Sakurai, Damier Bolore, Frederik Van Hoof, and Ana Aznar). Third place went to the big EGO company, based on an Environmental Glass Organization, set up to win a large international prize by solving a major social issue (Thorben Welter, Laura Aalta-Setala, Julian Moriceau, Ben Allsopp, and Philipe Kiefer).

Another ICG summer school program is already scheduled for July 2017 and will feature sessions focused on glass science and the use of computer modeling in glass science and technology. Visit ICG's website for more information (icglass.org). ■

Panasonic debuts OLED-embedded transparent-glass TV

Television has come a long way since it first started broadcasting moving images into households almost a century ago. But, TV is going to new places—and, if Panasonic is any prognosticator, TV receivers of the future will be almost invisible in our homes.

The electronics giant recently unveiled its latest concept of an invisible TV that seamlessly blends into a house's décor. When off, the new TV looks no different from an ordinary panel of glass—but when switched on, it provides a bright display that is almost indistinguishable from that of a conventional TV.

According to an *Engadget* article, the new invisible TV is a glass panel with an embedded mesh OLED screen, offering up unprecedented picture quality when turned on yet ultratransparency when off.

A video from Panasonic showing off the tech company's latest concepts is available at youtu.be/eoIQmWd8LTQ. ■

Credit: Panasonic Newsroom; YouTube

Panasonic's vision is that future televisions will be barely noticeable.

Wearable tech company Amazfit debuts ceramic wearable activity tracker

Wearable tech company Amazfit recently debuted its simple ceramic activity tracker in the United States market—and at a retail price of $79.99, it provides a more affordable ceramic option than the new Apple Watch.

Akin to the Misfit brand, Amazfit's tech design is aimed toward individuals who want an activity tracker "disguised as a fashion accessory," as Amazfit describes.

Amazfit's wearables consist of a donut-shaped zirconium oxide ceramic casing that houses its "new-generation ADI sensors" and a small-yet-mighty battery that boasts 10 days of life from a single charge.

According to the press release, the ceramic casing "undergoes 30 manufacturing procedures" before being polished to a shiny wearable. "Its hardness is second only to diamond and sapphire, creating a long-lasting, luminescent, and strong surface." Amazfit's website further details that the zirconium oxide material is fired at 2,642°F.

Credit: Amazfit

Amazfit is a wearable tech company that is debuting new fashionable ceramic activity trackers.

The ceramic makes the tracker tough and waterproof, yet lightweight—it weighs in at just 0.5 oz.

Amazfit launched as a U.S. wearable tech company in 2016, although its tech is not new—the company is owned by larger global wearable tech manufacturer Huami. Huami is a leading global wearable tech provider that partners with Xiamoi, a company that has had marked success with economical activity trackers in Asian markets.

"After selling more than 24 million activity trackers in China through our partnership with Xiaomi, we're excited to further expand our success into the U.S. market," Frederik Hermann, who leads Amazfit's U.S. marketing and sales, says in a recent press release.

To see and hear more from the company's industrial design team, watch the Amazfit video at youtu.be/K7Z2eSCAtMQ. ■

Ceramic Tech Today blog

www.ceramics.org/ceramictechtoday

Society and Division news

Welcome to our newest Corporate Members!

ACerS recognizes organizations that have joined the Society as Corporate Members. For more information on becoming a Corporate Member, contact Kevin Thompson at kthompson@ceramics.org, or visit www.ceramics.org/corporate.

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ACerS establishes first international chapter

ACerS Board of Directors approved its first application for the establishment of an international chapter at its recent meeting in Salt Lake City, Utah. The United Kingdom Chapter of ACerS will be based at Imperial College London and will be led by Eugenio Zapata-Solvas. "This is a great opportunity, and I will try my best to make it successful," says Zapata-Solvas. To become involved in the U.K. Chapter, contact eugenio.zapata-solvas@imperial.ac.uk. ■

Members: Save time with multiyear renewal

If your membership expires this month—and many do—or even if you have another expiration date, please take time to renew now. To renew online, visit ceramics.org and click the "Renew" button or call customer service at 866-721-3322 (U.S.) or 240-646-7054 (outside U.S.), or email customerservice@ceramics.org. Tired of getting renewal notices every year? Let customer service know you would like the multiyear renewal option that lets you decide how many years to renew. ■

Names in the news

Singh honored with Keramos Award in Krakow, Poland

Credit: Mrityunjay Singh

From Left to right: Jerzy Lis, vice rector of AGH; Singh; and W. Mozgawa, dean, faculty of materials science and ceramics at AGH.

AGH University of Science and Technology awarded ACerS then-president Mrityunjay Singh with the Keramos Award. The award is bestowed on individuals who have made outstanding scientific and technological contributions. Singh was recognized during the opening of Polish Ceramics 2016-IX International Scientific and Technological Conference in Krakow, Poland, September 12. ■

Society of Glass Technology celebrates 100th anniversary

Credit: SGT

Edgar Zanotto (left) and David Pye (right) with the stained glass artwork commissioned by ACerS GOMD to commemorate SGT's 100th anniversary. Pye designed and created the piece.

Credit: SGT

Russell Hand, SGT president, accepts a plaque from Kathleen Richardson, ACerS past president, congratulating the SGT on behalf of ACerS members.

Successful golf outing for Pittsburgh Section

ACerS Pittsburgh Section hosted its annual golf outing September 12 at Lenape Heights Golf Resort in Ford City, Pa. Participants enjoyed a complete program of special events, 18 holes of golf, refreshments, prizes, and awards. This year's first place team included Michael Neiport, Rob Conn, Garrett Sullivan, and Jack Tomina. Second place went to Chad Rittle, Eric Meuschke, Jay Hope, and Mike DeLucia. Third place went to Greg Andrews, Leslie Beiter, Robert Christensen, and Chris Beiter. The Pittsburgh Section thanks all who participated and donated prizes, including the following sponsors: Aluchem, CeramTec, Fusion Ceramics Inc., Henry F. Teichmann, Imerys/KT Clay, Morgan Advanced Materials, Rath, Standard Ceramic, ThermalMax, and Vanderbilt Minerals LLC. ■

2016 Ceramographic Exhibit and Contest winners

Congratulations to the winners of the 2016 Ceramographic Exhibit and Contest, which took place during Materials Science & Technology 2016 in Salt Lake City, Utah. Sponsored by the Basic Science Division, this annual competition promotes microscopy and microanalysis tools for investigating ceramic materials. The winning entries will be showcased on the back covers of the *Journal of the American Ceramic Society* in 2017.

WINNERS BY CATEGORY

Scanning transmission electron microscopy

First place and Roland B. Snow Award for Best in Show

Silicon brains
Ezra Feilden, **Finn Guiliani**, **Luc Vandeperre**, and **Eduardo Saiz**, Imperial College, London

Second place

Vapor-deposited ZnO neural network
Derek R. Miller, Ohio State University

Third place

Waves of the MXene ocean and castaway on the boride sea
Sankalp Kota, **Michael Ghidiu**, and **Michel W. Barsoum**, Drexel University

Transmission electron microscopy and scanning transmission electron microscopy

First place

Nitrogen atoms inside the nitride
Akihito Kumamoto, **Eita Tochigi**, **Naoya Shibata**, and **Yuichi Ikuhara**, University of Tokyo

Second place

I'm B_4C, can you find my flaw
Christopher Marvel and **Martin Harmer**, Lehigh University; **Kristopher Behler**, **Scott Walck**, and **Jerry LaSalvia**, Army Research Laboratory

Third place

A window of transformation
Kevin P. Anderson, **Mary Anne Lynch**, **Richard P. Vinci**, and **Helen M. Chan**, Lehigh University

Microanalysis/combined techniques

First place

Effects of the interlayer incorporation of H_2O in potassium hexaniobate followed by dehydration
Lynn Boatner, **Shirley B. Waters**, **Tom Greer**, and **Joanne O. Ramey**, Oak Ridge National Laboratory

Second place

Copper power lines
M. Kracum, **C. Marvel**, **M.P. Harmer**, and **H.M. Chan**, Lehigh University

Third place

Like lanthanum on spinel
Sanchita Dey, **Md Hasan**, and **Ricardo H.R. Castro**, University of California Davis; **John Mardinly**, Arizona State University ■

Remembering ACerS Distinguished Life Member Hans Hausner

Hans Hausner, founding member of the European Ceramic Society (ECerS) passed away August 26 at age 89. As the second President of ECerS (1989–1991), he helped create the International Ceramic Federation and served as ICF president from 1993–1995. Additionally, Hausner was a member of the World Academy of Ceramics and a Fellow and Distinguished Life Member of the American Ceramic Society. ■

In memoriam
Wolfgang Haller
Hans Hausner
Irving Klaus

Some detailed obituaries also can be found on the ACerS website, www.ceramics.org/in-memoriam.

Students and outreach

The Refractories Institute announces 2016 scholarship winners

The Refractories Institute (TRI) awarded academic scholarships to ACerS student members Anna Mattione (Missouri University of Science and Technology) and Sankalp Kota (Drexel University). TRI awards scholarships of $5,000 to students enrolled full-time for an undergraduate or advanced degree in ceramic engineering, materials science, or a similar discipline at a North American college or university. For more information, visit www.refractoriesinstitute.org. ■

MS&T16 student contest winners

The Material Advantage Student Program sponsored five contests for undergraduate and graduate students during MS&T16 in Salt Lake City, Utah. Thank you to all who helped judge and organize the contests this year, and congratulations to all winners.

Material Advantage Graduate Student Poster Competition

First place

Jamesa L. Stokes, Pennsylvania State University
Assessment of mechanical behaviors of co-evaporated EBPVD TBCs with varying rare earth content

Second place

Lindsey Pruden, University of Utah
Plasmonic, flexible, free-standing, monolayer gold nanoparticle films for plasmonic applications

Third place

Leila Ghadbeigi, University of Utah
High-performance Na-β-alumina electrolite doped with iron oxide

Students and outreach (continued)

Material Advantage Undergraduate Student Poster Competition

First place

Jacob Kline, University of Idaho
Doubling the life of concrete structures

Second place

Andrew Nguyen, University of Connecticut
Design, fabrication, and characterization of collagen-based multi-zonal scaffolds for osteochondral tissue engineering

Third place

Daisy M. Margrave, Montana Tech of the University of Montana
Deposition of rare earth elements on ion-exchange resins

Honorable mention

Justin Weinstein, Rensselaer Polytechnic Institute
Melting prevention of superalloys in high temperature heat treatments

Material Advantage Undergraduate Student Speaking Contest

Winner

Wyatt Surbey, Virginia Polytechnic Institute and State University
Bio-inspired tissue repair

First runner up

Evan Musterman, Missouri University of Science and Technology
Mechanization of flat glass production

Second runners up

Sarah Rappaport, Northwestern University
The atomic layer deposition of tin sulfide

Joshua Tedesco, Rutgers University
Potassium doped silica nanoparticles as an advanced, ecofriendly, and economical insecticide

Material Advantage Ceramic Mug Drop Contest (organized by Keramos)

Winner (passing @ 120 cm drop)

Michael Hu, University of Illinois at Urbana-Champaign

Most aesthetic mug

Stephanie Soendker, Missouri University of Science and Technology

Most aesthetic disc

Elisabeth Lang, University of Illinois at Urbana-Champaign ■

Material Advantage Ceramic Disc Golf Contest (organized by Keramos)

Winner (7 m winning throw)

Reed Coots, Clemson University

Awards, scholarship opportunities for students

ACerS Nuclear & Environmental Technology Division sponsored six $500 travel stipends to help students fund their attendance to MS&T16 in Salt Lake City, Utah. Congratulations to this year's winners: Claudia Gasparrini, Imperial College London; Austin Travis, University of California, Irvine; Hwasung Yeom, University of Wisconsin-Madison; Kassiopeia Smith, Boise State University; Theresa Davey, Imperial College London; and Helen Pratt, University of Oxford.

Additionally, ACerS Basic Science Division recently announced the winners of its 2016 Graduate Excellence in Materials Science (GEMS) awards.

Diamond ranking

Joseph Muth, Harvard University
Kate Reeve, Purdue University
David Kok, University of California, Irvine

Sapphire award

Swetha Barkam, University of Central Florida
Hwasung Yeom, University of Wisconsin-Madison
Cody V. Cushman, Brigham Young University
Lisa Rueschhoff, Purdue University
Theresa Davey, Imperial College London

Graduate students whose abstracts are accepted for a talk at MS&T17 should consider applying for the 2017 GEMS Awards. For more information, visit ceramics.org/awards.■

Apply by December 31 for Washington, D.C. engineering internship

ACerS will support an intern in the Washington Internships for Students of Engineering (WISE) 2017 program. U.S. citizens or legal permanent residents who are juniors or seniors entering their final year of undergraduate studies are eligible. WISE also accepts applications from engineering graduates who are beginning master's level study in a technology policy-related degree. Applications are due **December 31** at noon (EST). Learn more at www.wise-intern.org or contact Tricia Freshour at tfreshour@ceramics.org.■

ACerS Winter Workshop for students returns in January

ACerS and The Ceramic and Glass Industry Foundation are co-organizing a Winter Workshop program for students with help from the President's Council of Student Advisors and the Young Professionals Network. The workshop welcomes students and young professionals from around the world and will be held in conjunction with the Electronic Materials and Applications 2017 conference in Orlando, Fla., January 18–22, 2017. For more information, visit ceramics.org/winter-workshop. ■

Awards and deadlines

GOMD awards nomination deadlines

ACerS Glass & Optical Materials Division invites nominations for the following awards:

- The **Stookey Lecture of Discovery Award** recognizes an individual's lifetime of innovative exploratory work or noteworthy contributions of outstanding research on new phenomena or processes involving glass that have commercial significance or the potential for commercial impact.
- The **George W. Morey Award** recognizes new and original work in the field of glass science and technology based on excellence in publication of work, either experimental or theoretical, done by an individual.
- The **Norbert J. Kreidl Award for Young Scholars** recognizes research excellence in glass science and is open to all degree-seeking graduate students (M.S. or Ph.D.) or those who have graduated within a 12-month period of the GOMD meeting.

Nominations for all three awards must be received by **January 21, 2017**. For more information, visit ceramics.org/awards or contact Erica Zimmerman at ezimmerman@ceramics.org. ■

Society award nominations due January 15

Nominations for most ACerS Society awards, including Distinguished Life Member, Kingery, Jeppson, Coble, Corporate Achievement, Spriggs, Friedberg, and Fulrath, are due **January 15, 2017**. For more information, visit ceramics.org/awards or contact Erica Zimmerman at ezimmerman@ceramics.org. ■

CERAMICANDGLASSINDUSTRY FOUNDATION

CGIF releases updated science kit

The Ceramic and Glass Industry Foundation announces the launch of the newly redesigned Materials Science Classroom Kit.

The kit, originally developed by the ACerS President's Council of Student Advisors, facilitates learning and inspires students to pursue careers in materials science. Feedback from teachers and other users was utilized to select the best demonstrations and interactive labs from earlier versions of the kit for inclusion into one convenient updated package.

The kit is the most comprehensive resource of its kind. Lessons comply with Next Generation Science Standards and STEM teachers from around the country are being introduced to this valuable, effective teaching tool.

To further assist those who teach materials science, the CGIF now includes the book, *The Magic of Ceramics*, in each kit. This popular book introduces the nontechnical reader to the many exciting applications of ceramics while teaching key scientific concepts.

ACerS individual and corporate members can sponsor a Materials Science Classroom Kit and *The Magic of Ceramics* book for a local school for only $250. For multiple orders, the sponsor's name will be added to the kit packaging to signify the source of the donation.

Contact Belinda Raines, outreach manager, at braines@ceramics.org for more information or go to ceramics.org/donateakit. ■

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The General Editors of the reference series *Phase Equilibria Diagrams* are in need of individuals from the ceramics community to critically evaluate published articles containing phase equilibria diagrams. Additional contributing editors are needed to edit new phase diagrams and write short commentaries to accompany each phase diagram being added to the reference series. Especially needed are persons knowledgeable in foreign languages including German, French, Russian, Azerbaijani, Chinese, and Japanese.

RECOGNITION:
The Contributing Editor's initials will accompany each commentary written for the publication. In addition, your name and affiliation also will be included on the Title Pages under Contributing Editors.

QUALIFICATIONS:
General understanding of the Gibbs phase rule and experimental procedures for determination of phase equilibria diagrams, and/or knowledge of theoretical methods to calculate phase diagrams.

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Ceramics and glass—Materials for diverse industries

A 2016 industry profile and manufacturing forecast

By April Gocha, Stephanie Liverani, and Eileen De Guire

The ceramic and glass industry cuts a wide swath across industries producing commodity products, such as brick, tile, and glass containers; to components, such as fasteners, multilayer capacitors, and armor; to highly engineered products, such as optical fibers, medical devices, jet engine components, and display glass for consumer electronics. The spectrum of applications along the way is densely packed.

Analysts categorize "the ceramic industry" into advanced technical ceramics and traditional ceramics (Figure 1). However, those in the industry recognize that the "traditional" industries, such as refractories and glass, produce highly engineered, innovative products that arguably qualify as advanced technical ceramics.

Specifically, the global advanced technical ceramic market was valued at $56.70 billion in 2015, according to a June 2016 analysis conducted by Grand View Research that looked internationally at product, application, and end-use projections through 2024.[2] The report covers markets for alumina, titanate, zirconate, and ferrite components (among other ceramic materials) in monolithic ceramics, ceramic coatings, and ceramic-matrix composites for electronic, automobile, machinery, environmental technologies, and medical applications.

"Numerous players are expected to increase their R&D expenditure to comply with growing demand from new applications, and most companies have been trying to improve their operations at a reduced cost, which in turn is expected to boost product market over the next eight years," the report states.

Another recent report from BCC Research estimates that the North American market alone for advanced technical ceramics was $4.5 billion in 2015 and projects it will grow to $6.7 billion by 2020, a compounded annual growth rate (CAGR) of 6.7% for the five-year span. Figure 2 shows how several sectors of the market are expected to contribute to the projected growth.[3]

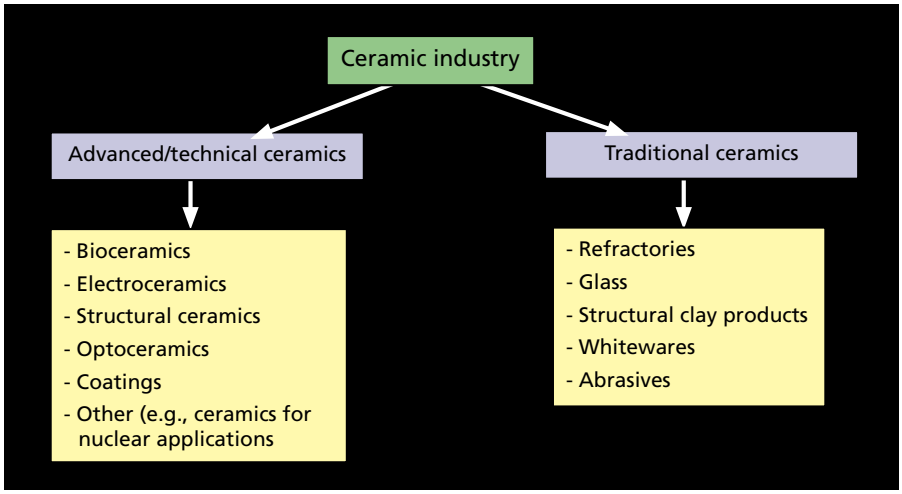
The aerospace industry provides an illustration of how an industry drives significant revenues across its supply chain, including ceramics. According to one report, global sales of gas-turbine engines in 2015

THE GLOBAL PICTURE

Beyond the United States, how does the worldwide economy look?

The International Monetary Fund (IMF) usually publishes its World Economic Outlook twice a year, representing a survey of staff economists' analyses of global economic developments. The outlook report published in October 2016 indicates subpar global growth of 3.1% in 2016, with a slight increase of 3.4% predicted for 2017.[1] "Taken as a whole, the world economy has moved sideways," IMF chief economist and economic counsellor Maurice Obstfeld says in the report. "We have slightly marked down 2016 growth prospects for advanced economies whereas marking up those in the rest of the world."

Stagnation in the U.S. market, uncertainty following the United Kingdom's exit from the European Union, and slow growth in Japan's leading economy are all contributing to this subpar market growth. But, despite the lackluster performance of those advanced markets, emerging markets are expected to pick up some of the worldwide slack with an overall 4.6% growth rate. China's economy is expected to expand 6.6% in 2016 and 6.2% in 2017, showing signs of slowing as the country shifts away from investment and industry and, instead, moves toward more sustainable reliance on consumption and services, according to the IMF. In addition, India is expected to continue to grow at one of the fastest paces for major world economies, with more mixed economic predictions in Africa and Latin America. ■



Credit: Gagliardi

Figure 1. Typical categorization of the ceramic industry.

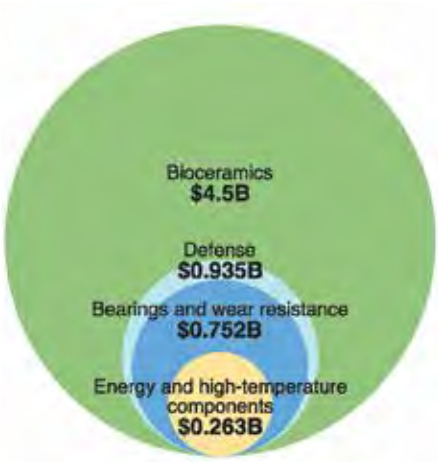


Figure 2. Market segments expected to contribute to growth of the North American advanced technical ceramic market. Projected market values by 2020.[3]

reached about $39 billion. Projecting out to 2028, domestic and military aircraft are estimated to generate sales of $1.07 trillion through 2028.[4]

Protective coatings—thermal barriers and environmental barriers—comprise one critical component of gas-turbine engines that use ceramic materials. The global ceramic coatings market, which includes aircraft applications, is estimated to reach $9.07 billion in 2020,[5] with about $1.9 billion contributed by the North American market.[6] Also, GE-Safran's much-anticipated LEAP engine with a 3-D-built ceramic-matrix composite component was introduced in fall 2016. GE's website says the company already has booked more than 6,000 orders valued in excess of $78 billion.[7]

In the future, new processes, such as additive manufacturing and polymer-derived ceramics, will lead to novel materials and novel forms. The projected market for 3-D-printed ceramic components of $131.5 million by 2021 reflects an industry continuing to learn how to use the technology. However, this projection represents a 29.6% CAGR, evidence of optimism in the industry for great opportunity.[8] Function will follow form as applications emerge for monolithic, composite, porous, fiber, or coating form factors.

Newly established events and initiatives dedicated to furthering technological advances in functional ceramics have gained traction over the past few years, drawing attention to the field and industry growth. Now in its third year, Ceramics Expo has secured its place as the annual event in North America that brings together companies and organizations that produce and rely on ceramic technologies. The American Ceramic Society also created The Ceramic and Glass Industry Foundation in 2014 to attract, inspire, and train the next generation of ceramic and glass professionals.

These factors signal a vibrant industry, but what specifically is driving growth and what will the future bring? The following profile examines industry indicators in the United States, including employment and output projections, manufacturing trends, and current priorities for the federal budget in FY 2017 when it comes to clean energy, emerging technologies, and transportation. The profile also looks at two specific ceramic sectors and reports recent revenue for some of the industry's heaviest hitters.

Broader industry indicators signal mildly optimistic manufacturing forecast

The Institute for Supply Management (ISM) is a worldwide professional supply management organization that provides economic indicators through its monthly publication, Report on Business. Based on a survey of manufacturing supply executives across a variety of industries, the report provides a general measure of the state of manufacturing and nonmanufacturing industries in the U.S., quantified as a Purchasing Manager's Index (PMI).

Although the figures are U.S.-centric, global manufacturers follow PMI scores, because they provide a snapshot of the overall economy and of the status of segmented industries. According to ISM, PMI scores "have been consistently accurate in indicating the direction of the overall economy in addition to the manufacturing and nonmanufacturing sectors."[9] Scores are provided as a percentage—scores greater than 50% indicate expansion, whereas scores less than 50% signal contraction.

ISM's most recent manufacturing PMI registered 51.5% in September 2016, with reported growth in seven separate industries, including nonmetallic mineral products.[10] Average PMI during the past 12 months is 50.3%, and average PMI during the past four years is 52.9% (Figure 3). ISM indicates that consistent PMI scores greater than 43.2% indicate overall economic expansion—by that measure, the latest score is the 88th consecutive month of expansion in the manufacturing sector, according to ISM.

To complement the ISM PMI scores, the U.S. Department of Labor's Bureau of Labor Statistics (BLS) tracks and publicly releases detailed economic information related to the U.S. labor market. This data-rich source of information provides overall and individual snapshots of metrics detailing employment and productivity for individual sectors, which can signal the overall health of those industries. Data come from the BLS Current Employment Statistics survey, which includes approximately 146,000 businesses and government agencies representing all 50 states.

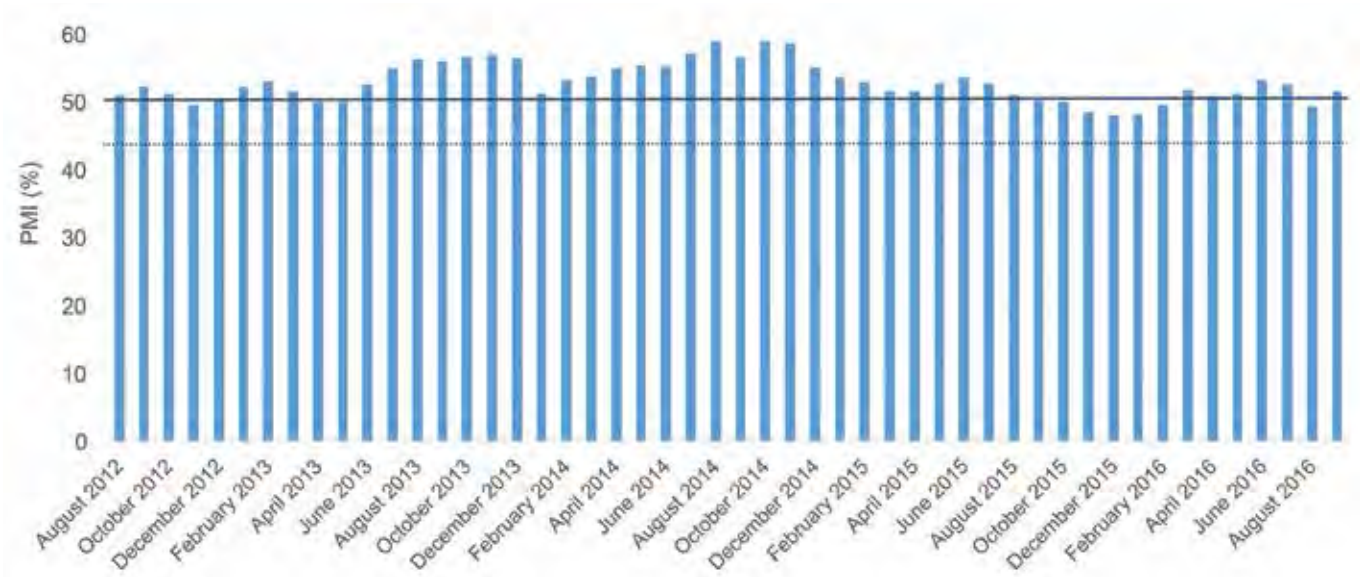


Figure 3. ISM U.S. manufacturing PMI scores from August 2012 to September 2016.[11] Scores greater than 50% (solid line) indicate expansion, whereas scores less than 50% indicate contraction. Consistent PMI scores greater than 43.2% (dotted line) indicate overall economic expansion.

BLS issues biennial data projections by industry, identifying sectors according to the North American Industry Classification System (NAICS) (see sidebar, page 21). According to statistics published in the December 2015 *Monthly Labor Review*, there is tempered optimism for the future: "With this set of biennial 10-year projections, the BLS presents a view of an economy that is returning to a more consistent growth path, but the growth is slower than the long-term trends that existed prior to the Great Recession."[12]

Overall, BLS predicts total U.S. employment will reach 160.3 million by 2024, representing a 0.6% CAGR. Productivity projections predict that overall U.S. output will reach $34.6 trillion in 2024, a 2.2% average annual increase from 2014 figures. Output has increased on average 1.0% annually from 2004 to 2014.

BLS further breaks its employment and output statistics into four main areas: goods-producing sectors (excluding agriculture); service-providing sectors; agriculture, forest, fishing, and hunting; and nonagricultural self-employed. The goods-producing sector is divided into mining, construction, and manufacturing.

Employment and output statistics for 2004–2014 and projections for 2014–2024 for the mining, construction, and manufacturing industries are shown in Table 1. Slow employment growth in mining is largely caused by uncertainty regarding future oil prices—increased horizontal drilling, hydraulic fracturing, and offshore exploration are expected to contribute to the increase in mining output.

The construction industry is predicted to add the most jobs to the goods-producing sector from 2014 to 2024, but will not reach prerecession levels, the report notes. Construction output, like construction employment, is expected to be fastest growing within the goods-producing sectors, with a growth rate that outpaces overall economic growth. Growth in residential and nonresidential investments is expected to contribute to the heightened output, with nonresidential investments finally getting back on track to surpass prerecession numbers by 2024.

Manufacturing jobs are projected to decline, but manufacturing output is expected to grow from 2014 to 2024. How can that be? According to the report, "Although manufacturing employment is projected to fall, real output in the manufacturing sector is expected to grow 1.9% annually to reach almost $6.6 billion in 2024, up from more than $5.4 billion in 2014. ... Increased productivity—because of automation, contract manufacturing, and a more efficient manufacturing process in most industries—will lead to more real output with fewer employees required."

In addition to the decrease in available skilled manufacturing jobs, the remaining jobs are shifting focus. Although this shift introduces challenges for skilled laborers, the changes could signal new growth opportunities for the manufacturing sector. The report continues, "Over the past few decades, manufacturing plants have become more automated, thus requiring skills that are more technical. For example, computer programmers and coders are needed by manufacturers, as are people to design and run the machines."

The manufacturing division within the goods-producing sectors is further

Table 1. BLS data on annual rates of change in employment and output for goods-producing sectors[12]

	Annual rate of change in employment, 2004–2014	Annual rate of change in employment, 2014–2024	Annual rate of change in output, 2004–2014	Annual rate of change in output, 2014–2024
Mining	4.9%	0.9%	2.1%	1.9%
Construction	–1.3%	1.2%	–3.0%	2.8%
Manufacturing	–1.6%	–0.7%	0.7%	1.9%

divided into specific manufacturing industries, again following NAICS code designations. NAICS code 327, manufacturing of nonmetallic mineral products, covers much of our industry's outputs (see sidebar for more information).

Nonmetallic mineral product manufacturing

Manufacturing of nonmetallic mineral products experienced an annual decline of 1.3% in output from 2004 to 2014, but is expected to grow at a rate of 1.8% from 2014 to 2024. All four divisions within this category—clay product and refractories; glass and glass products; cement and concrete products; and lime, gypsum, and other products—are expected to increase output from 2014 to 2024, with the greatest gain in cement and concrete product manufacturing at a 2.5% annual rate of change.

The U.S. Census Bureau's Annual Survey of Manufactures provides estimated statistics for U.S. manufacturing establishments based on a sample survey of approximately 50,000 establishments selected from the most recent Economic Census.[13] The most recent survey from 2014 provides, among much more data, statistics on the total value of products shipped, broken down by NAICS codes.

Total value of shipments of nonmetallic mineral products overall grew 26% from 2010 to 2014. Values of clay products and refractories shipments increased 15%; glass and glass products increased 20%; cement and concrete products increased 25%; and lime, gypsum, and other products increased 45% (Figure 4).

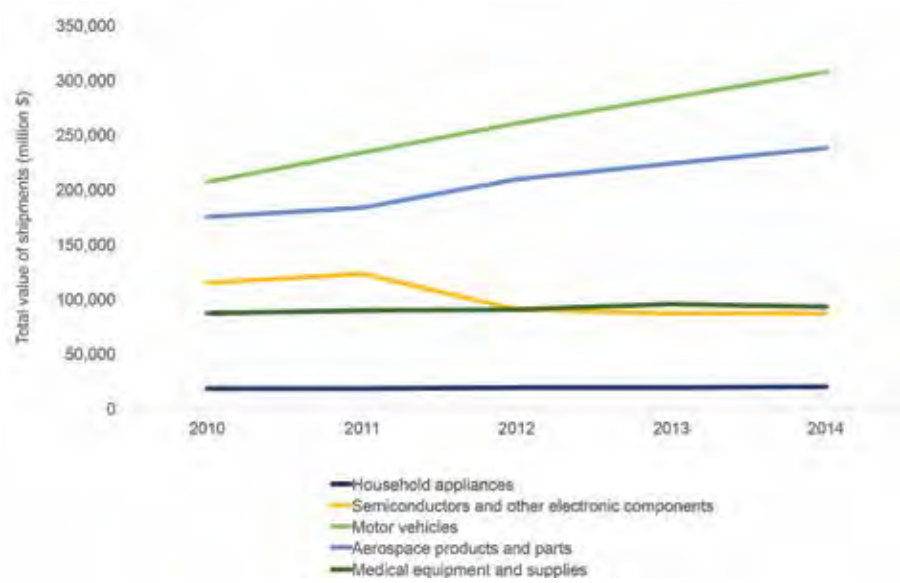


Figure 4. Total value of products shipped during 2010–2014 for NAICS code 327, manufacturing of nonmetallic mineral products. Data are from the U.S. Census Bureau's most recent Annual Survey of Manufactures.[13]

Manufacturing in selected end-use industries

Typically ceramic and glass materials are used in complex systems, such as automobiles or buildings, or are used to manufacture other goods. Refractories are an example of the latter. Thus, trends in end-use industries can have important implications for ceramic and glass industry sectors. What follows are indicators for few key industries—not a comprehensive list of end-use industries—that utilize a large proportion of ceramic and glass materials.

Manufacturing of computer and electronic products (NAICS code 334) experienced an annual increase of 2.6% in output from 2004 to 2014 and is expected to continue to grow at that rate from 2014 to 2024.

Manufacturing of electrical equipment, appliances, and components (NAICS code 335) experienced a decline of 0.7% in output from 2004 to 2014 and is expected to grow at a rate of 2.1% from 2014 to 2024.

Manufacturing of transportation equipment (NAICS code 336) experienced an increase of 1.9% in output from 2004 to 2014 and is expected to grow at a rate of 1.3% from 2014 to 2024.

Manufacturing of miscellaneous products (NAICS code 339) experienced an annual growth of 3.3% in output from 2004 to 2014 and is expected to continue to grow at that rate from 2014 to 2024. Manufacturing of medical equipment and supplies, which includes orthopedic devices and dental prosthetics, falls within this catch-all category and is expected to grow at an annual rate of 3.3% from 2014 to 2014, slowing from a growth rate of 5.6% from 2004 to 2014.

Data on total shipments for each of these categories during the past five years can be found in Figure 5.

Sales data provide a sense of scale for the industry

Although general manufacturing and industry trends provide a broader context, such high-level metrics also can gloss over more nuanced trends within a particular sector, and many metrics and indexes exist to measure industry and business health.

Here we focus on sales data for select companies to provide a sense of the scale of industry contributing to the sectors' overall commerce. Care should be taken to not over-interpret these data. For example, sales data at most companies reflect revenues from sales of more than ceramic and glass products. Also, sales data exclude the cost of doing business and similar considerations. Data sources and its timeliness are noted in the tables. Most data are from Mergent Intellect, formerly known as Dun & Bradstreet's Million Dollar Database and company websites.

Table 2 presents sales data and market drivers for select ceramic and glass manufacturing companies. Large companies, such as GE and 3M, are as much end users as suppliers, and their highly diversified product portfolios generate massive revenues. However, the table also shows the broad range of contributors to the industry's commerce. Even small companies like Du-Co Ceramics and Superior Technical Ceramics are multi-million dollar enterprises.

In addition, we highlight two industries, each broad in its own right—electroceramics and refractories. The summaries that follow provide a snapshot glimpse of the sectors, their corporate composition, and the industry's drivers.

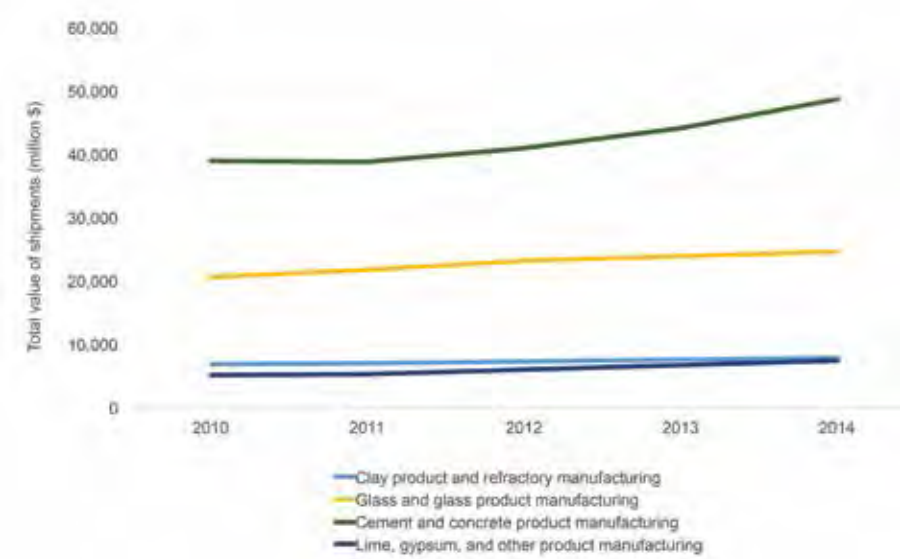


Figure 5. Total value of products shipped during 2010–2014 for selected end-use industries. Data are from the U.S. Census Bureau's most recent Annual Survey of Manufactures.

This market profile is representative, but not comprehensive. Inevitably, some companies are not included that could have been. Thus, we invite readers to suggest companies or sectors to profile in the future (see author contact information on p. 20).

Electroceramics

The electroceramics segment of the advanced technical ceramic industry manufactures ceramic piezoelectrics, capacitors, insulators, resistors, and conductors. Integration of electronics into systems such as automobiles, energy technologies, medical devices, buildings, appliances, industrial equipment, and the Internet of Things drive demand for better, faster, cheaper, lighter electronics, and in turn, drive the electronic components industry. Arguably, batteries and energy conversion devices, such as fuel cells, could be included in this category, but those sectors are excluded for this profile even though some companies also produce energy conversion and storage technologies.

The number of components manufactured is staggering—one report estimates Chinese manufacturers made 1.98 trillion multilayer ceramic capacitors (MLCCs), which fell short of meeting an estimated demand for more than 2 trillion MLCCs in 2015 in China alone.[14] Market research analysts value the ceramic capacitor global market at $7–$10 billion in 2015[15] and the piezoelectric market at more than $20 billion in 2015.[16] Note that the piezoelectric market includes piezoceramics as well as polymer- and composite-based devices. The market for spark plugs, an insulation application, is expected to climb to $2.8 billion in value by 2019 at a CAGR of 5.26%.[17]

Table 3 summarizes sales and key business drivers for select companies in the sector. Sales data show the top three companies—all Japan-based—generate revenues of $5–$10 billion yearly. Samsung Electro-Mechanics is gaining on its next competitor, TDK, and is reported to have passed it in MLCC sales since 2009.[14]

The business drivers for these largest companies—Kyocera, Murata, TDK, and Samsung—come from applications in telecommunications, automobiles, sensors, industrial equipment, electronic devices, and medical technology. Several major brands are owned by larger companies. For example, TDK owns EPCOS, and Kyocera owns AVX and its subsidiary American Technical Ceramics.

Murata Manufacturing Company (Kyoto, Japan) provides an example of the magnitude of the business in this sector. Murata dominates the MLCC market with a 22.8% share in 2015 according to a Research and Markets report.[14] Sales data (Figure 6) from the company's 2015 annual report show how products within its portfolio have generated increasing revenues during a five-year span.[18]

Other companies listed in Table 3 report significant revenues—sales in the

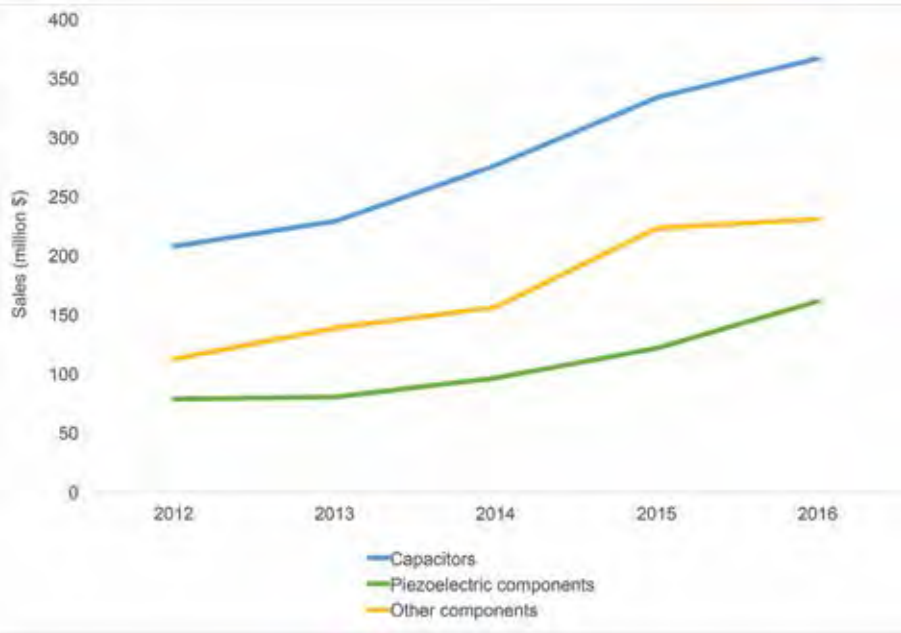


Figure 6. Rising trends for Murata five-year sales of electronic parts and components. Data are for FY ending March 31 and are based on an exchange rate of ¥1= $0.0096 on 10/6/2016. Source: www.murata.com/en-us/about/ir/financial/products (accessed 10/6/2016).

Table 2. Sales data for companies selling, using, or developing advanced technical ceramic components

Company	Location	Sales, $M	Data recency	Description
General Electric Co	U.S.	117,386	July 2016	GE supports its Global Research Center with a budget of ~$5B. Technologies include aircraft engines, locomotives and other transportation equipment, lighting, electric control equipment, generators and turbines, and medical imaging equipment. Businesses include Aviation; Capital; Digital; Energy Connections; Healthcare; Lighting; Oil & Gas; Power; Renewable Energy; and Transportation.
Saint-Gobain Group	France	43,500	October 2016	Operates in 66 countries. Sales is divided into: 48% building materials distribution; 24% innovative materials (flat glass and high-performance materials); 28% construction products (plaster, insulation, tile adhesives, industrial mortars, cast iron pope, wall facings, and siding).
3M Co	U.S.	30,274	July 2016	Five operating segments: Industrial; Safety and Graphics; Electronics and Energy; Health Care; and Consumer. Business drivers are healthcare, electronics, and alternative energy.
• Ceradyne, a 3M Co	U.S.	543	May 2016	Owned by 3M. One-third of sales are to U.S. government and its agencies. Applications include armor for military helicopters, missile nose cones, body armor and helmets, diesel engine components, ceramic industrial products, solar glass products, and orthodontic brackets. Business drivers are defense, automotive, and aerospace.
PPG	U.S.	15,330	July 2016	Manufactures coating materials, fiberglass, and flat glass at 156 manufacturing facilities in 70 countries. Business drivers are aerospace, architecture, automotive, industrial equipment, consumer electronics, and specialty coatings.
Kyocera Corp	Japan	12,645	June 2016	Industries served include telecommunications, automotive, medical, electronics, and industrial manufacturing, among others. In addition to manufacturing components, the company produces electronic products, such as wireless phones and office equipment. Business drivers are sensors, smartphones, energy, electronics, and LEDs.
Corning Inc	U.S.	9,111	July 2016	Operates 90 facilities in 17 countries. Business drivers are consumer electronics, telecommunications, automotive, and life science.
Owens-Illinois	U.S.	6,156	July 2016	Manufactures glass containers in more than 10,000 varieties for customers in 85 countries. Business drivers are food/beverage and pharmaceutical.
Federal-Mogul Corp	U.S.	6,117	April 2016	U.S.-based business generates 38% of total revenue, followed by German market with 24% of sales. Products include pistons, spark plugs, ignition coils, bearings, gaskets, seals, and brake pads. Business drivers inlcude automotive.
Owens Corning	U.S.	5,350	July 2016	Manufactures glass fiber insulation, roofing, and fiberglass for composites. Business drivers are transportation, industrial, infrastructure, marine, wind energy, and consumer products. .
NGK Spark Plug Co Ltd	Japan	3,275	July 2015	Automotive parts, such as spark plugs and automotive oxygen sensors, generate more than half of sales. Balance comes from sales of semiconductor and electronic components; medical products, such as artificial bone and oxygen concentrators; industrial components; and cutting tools. Business drivers are automotive and orthopedics.
Osram GmbH	Germany	2,078	July 2016	Business drivers are lighting, LEDs, photonics, lasers, and automobiles.
Morgan Advanced Materials PLC	U.K.	1,375	July 2016	Organized into two divisions—Thermal Products; and Carbon and Technical Ceramics—encompassing five business units. The Composites and Defence Systems unit is outside the division structure. Business drivers are electronics, energy, healthcare, industrial equipment, petrochemical industry, defense, and transportation.
Ferro Corp	U.S.	1,075	June 2016	Produces glazes, colorants, pigments, and enamels. Business drivers are paint and coatings, chemicals, auto exteriors, and appliances.
CoorsTek Inc	U.S.	954	June 2016	CoorsTek also offers materials testing, analytical chemistry, custom manufacturing, precision machining, and other services. Business drivers are automotive components, energy equipment, medical devices, and high-performance machinery.
CeramTec GmbH	Germany	538	April 2016	Industries include automotive parts, clay refractories, ceramic fiber, electronic equipment housewares, and pottery.
Rauschert Heinersdorf–Pressig GmbH	Germany	159	April 2015	Products include technical ceramics, functional components, ignition systems, and heating elements.
Superior Graphite Co	U.S.	94	May 2016	Manufactures graphite and silicon carbide for various applications, including batteries, fuel cells, machine lubricants, technical ceramics, and printer toner.
Du-Co Ceramics Co	U.S.	35	May 2015	Manufactures technical ceramic components of steatite, cordierite, porcelain, magnesium oxide, alumina, mullite, and forsterite. Product lines include ball and socket beads, bushings, thermocouple tubes, ceramic tape, crushable ceramics, and custom parts.
Superior Technical Ceramics	U.S.	34	May 2016	Custom manufacturer of technical ceramic components. Applications include aerospace, fuel cells, optics, medical, defense, oil and gas, paper and pulp, scientific instruments, semiconductor processing, and telecommunications.
McDanel Advanced Ceramic Technology LLC	U.S.	24	January 2015	Manufactures ceramic tubes, rods, crucibles, labware, and components of high-purity alumina, mullite, fully stabilized zirconia, and SiAlON. Applications include protective atmospheres, corrosive environments, and high temperatures.
Amedica Corp	U.S.	19	July 2016	Manufactures joint and spine implants made of silicon nitride.

Data are from Mergent Intellect, formerly Dun & Bradstreet Million Dollar Database (accessed 9/27/2016), and websites [http://qz.com/355116/ges-5-billion-annual-rd-budget-is-transforming-advanced-manufacturing-and-the-industrial-internet/ (accessed 10/5/2016); www.saint-gobain.com/en/group/about-saint-gobain (accessed 10/5/2016; currency converted as 1.10E=$1); http://solutions.3m.com/wps/portal/3M/en_US/3M-Company/Information/Profile/Performance/ (accessed 10/16/16); http://www.morganadvancedmaterials.com/en-gb/about-us/strategy/ (accessed 11/1/16); http://www.du-co.com (accessed 11/1/16); http://www.ceramics.net. (accessed 11/1/16); http://www.mcdanelceramics.com/about (accessed 11/1/16); http://investor.ppg.com/~/media/Files/P/PPG-IR/financial-information/annual-reports/2015-annual-report.pdf (accessed 11/1/16)].

Table 3. Sales revenues for select companies in the electroceramics sector (data represent total revenues across entire product lines, including non-electroceramic products)

Company	Location	Sales, $M	Data recency	Description
Kyocera	Japan	$12,645	June 2016	Electronic and semiconductor components for telecommunications, auto, medical, electronics, and industrial manufacturing.
• AVX Corp	U.S.	$1,196	June 2016	Kyocera owns controlling stake. Produces passive electronic components for autos, copiers, hearing aids, locomotives, and cell phones. Business drivers are transistors and ultracapacitors.
– American Technical Ceramics Co	U.S.	$148	June 2016	Subsidiary of AVX, a Kyocera company. Manufactures single layer and MLCC for cell phones, instrumentation, radar, broadcast satellites, military, and aerospace applications. Business drivers are transistors, electrical connectors, ultracapacitors, and semiconductor supply chain.
Murata Manufacturing Co Ltd	Japan	$10,348	May 2016	Manufactures passive electronic components, primarily capacitors. Business drivers are sensors and electronic devices.
TDK Corp	Japan	$9,847	July 2016	TDK owns EPCOS. Products include ferrite magnets, transformers, and MLCC. Business drivers are sensors and electronic devices. Has operations in 30 countries; 90% of revenue is generated outside Japan.
• EPCOS AG	Germany	$2,487	May 2016	Owned by TDK. Produces capacitors, including MLCC, ceramic components, ferrites, inductors, and resistors. Business drivers are sensors and electronic devices.
Samsung Electro-Mechanics	South Korea	$5,913	October 2016	Manufactures MLCC, passive electronic components, and more.
NGK Insulators Inc	Japan	$3,724	June 2016	Business drivers are electric power and semiconductors.
NGK Spark Plug Co Ltd	Japan	$3,275	July 2015	Produces spark plugs, auto sensors, and semiconductor and electronic components. Technical Ceramics segment produces medical products, industrial components, and cutting tools. Business drivers are automotives and orthopedics.
Taiyo Yuden Co Ltd	Japan	$2,054	May 2016	Business drivers are transistors, capacitors, and semiconductor industry.
Vishay Intertechnology	U.S.	$2,300	August 2016	Manufactures passive electronic components, including inductors, capacitors, and resistors, and also semiconductor components, such as diodes, MOSFET, and solid state power control switches. Business drivers are sensors, semiconductor applications, LEDs, and lighting.
Nippon Chemi-con Corp	Japan	$1,012	August 2015	Manufactures electronic capacitors and ultracapacitors. Business drivers are personal computers, printed circuits, and microelectronics.
Yageo Corp	Taiwan	$847	July 2016	Manufactures resistors, MLCC, and ferrites. Business drivers are capacitors, radio frequency applications, and telecom munications.
KEMET Corp	U.S.	$735	November 2015	Produces 35 billion capacitors/year for aerospace, automotive, communication systems, computers, and military equipment. Business drivers are transistors, semiconductor suppply chain, electrical connectors, and ultracapacitors.
KOA Corp	Japan	$435	March 2016	Manufactures resistors, thermistors, inductors, fuses, varistors, and LTCC substrates. Applications include automotive, telecommunication, home appliances, consumer electronics, and energy efficient devices. Business drivers are capacitors, ultracapacitors, semiconductors, and power transmission.
Morgan Technical Ceramics	U.K.	$300	October 2016	Segment of Morgan Advanced Materials that produces high-voltage capacitors, rf capacitors, piezoceramics, and other technical ceramics.
Piezo Kinetics Inc	U.S.	$6	June 2015	Manufacturers piezoceramics.

Data are from Mergent Intellect, formerly Dun & Bradstreet Million Dollar Database (accessed 9/27/2016), and company websites [www.murata.com/en-us/about/ir/financial/products (accessed 10/6/2016); www.samsungsem.com/global/news/index.jsp?artId=1396649 (accessed 10/4/16); www.koaglobal.com/ir/highlight (accessed 10/30/16; currency converted 10/30/16); www.morganadvancedmaterials.com/en-gb/investors/financial-highlights/divisional-performance/ (accessed 10/4/16; currency converted 10/6/2016)].

billions will always be impressive—but clearly they face challenging competition from the industry's giants. Business drivers for these "smaller" companies include semiconductor and electronic devices, electric power, automotives, sensors, telecommunications, and defense.

Refractories

It has been said that if you are in the refractories business, you are in the steel business. The iron and steel industry consumes about 60% of global refractory production, with the rest serving the glass, cement, nonferrous, energy, and petrochemicals industries (Figure 7).[19]

The combined refractories and clay building materials industry generates revenues and has a consolidated supplier base that suggest a delayed response to the Great Recession. Figure 8 compares 10-year trends for revenues and the number of companies operating under NAICS code 327120, "clay building material and refractories manufacturing."

At the industry's peak in 2009, 317 companies operated in this sphere and generated almost $95 billion in sales, according to Gale Business Insights database.[20] By 2013, the number of active companies dropped to 80 worldwide, with annual global revenues of almost $14 billion.

Data from 2014 appear to point to the beginning of a recovery for the industry, although further consolidation looks imminent with the merger between RHI and Magnesita to form RHI Magnesita.[21] The deal—announced October 5, 2016—will be effective in 2017 if approved by government regulating agencies. The new company would be based in The Netherlands.

The global impact of the Great Recession, however, is only part of the story. Advances in refractories engineering have led to increased efficiency and

longer furnace campaigns for steelmaking. To illustrate, in a 2014 *ACerS Bulletin* article, Charles Semler reported refractory consumption from 1950 to 2010 dropped from 61 kg/(ton steel) to 15 kg/(ton steel)—some steel plants even achieved extreme efficiencies of 7–8 kg/(ton steel).[22] Trends in refractory engineering include an increase in the use of unshaped monolithic refractories over brick and improved castables, along with improved shotcasting and gunning processes. Nonetheless, overall consumption of refractories by the iron and steel industry is increasing (Table 4).

As the high-volume carbon-steel-producing industry gains efficiency, longer-lasting refractories means slower turnover for refractory producers. In contrast, alloyed steels and other high-quality materials drive development of refractories engineered to specific needs. In a recent paper, Buhr et al.[23] note that more than 2,000 grades of steel are on the market—each with properties engineered for specific applications. These steel operations call for refractories engineered for high-performance in critical areas, such as ladle linings, purge plugs, and sliding gates.

New technologies in refractory engineering also push industry innovation. The dusty refractories plants of old are giving way to modern plants with the ability to engineer customized refractory solutions and robotic production lines. Future refractories will be highly engineered, high-performance materials systems, some with functionality not imagined previously. Emerging ideas include refractories with shape-engineered aggregate, nanoparticle additions to control pore-space properties, self-healing refractories, and refractories that can "clean" steel at interfaces.

Table 5 lists select refractory producers worldwide. A handful of companies achieve yearly revenues in the billion-dollar neighborhood of $924 million to more than $5 billion. Other companies generate revenues in the hundreds of millions. Interestingly, a fair number of smaller companies produce revenues in the tens of millions. The market also supports smaller companies (not listed) that post revenues less than $10 million per year.

R&D top priority in FY 2017: Renewable energy and emerging technologies

Beyond output, employment, and sales data, another important measure of the health and trajectory of an industry is the amount of money diverted to R&D. The National Science Foundation (NSF) tracks business R&D expenditure data with its Business Research and Development and Innovation Survey (BRDIS). BRDIS provides data on domestic and global R&D expenditures at for-profit businesses based on a survey conducted annually by the U.S. Census Bureau in accordance with NSF's National Center for Science and Engineering Statistics. The latest report, issued this year, details statistics from 2013.

Dollars spent on R&D at businesses worldwide in 2013 greatly varied by sector, with semiconductor and other electronic component manufactur-

Table 4. Refractory consumption rates per ton of steel [20]

Year	Refractory demand (10^6 metric tons)	Notes
2000	30.4	Based on 25 kg/(ton steel) produced
2012	32.6	Based on 20 kg/(ton steel) produced
2012	43.4	Based on 15 kg/(ton steel produced)
2016	46.3	
2020	55	

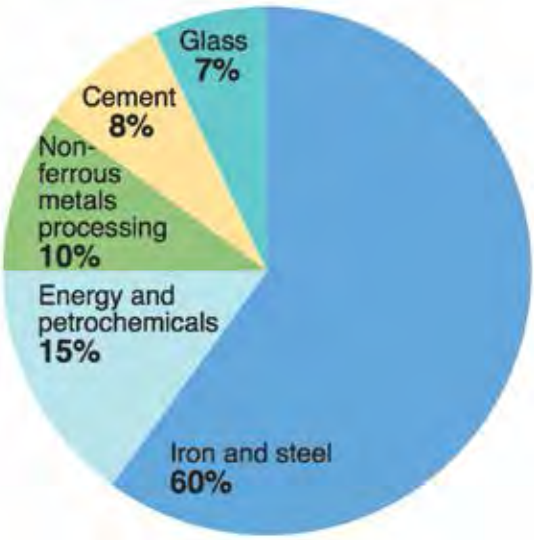


Figure 7. Major industries that consume global refractory production.[19]

Figure 8. Ten-year sales trend (red line) for companies active in clay building material and refractories manufacturing, which includes nonrefractory manufacturers, such as brick and clay-tile manufacturers. Sales revenue reflects the trend for number of companies active in the sector (blue line). These data include products such as architectural brick, clay roof tile, and clay pipe, and exclude nonclay refractories.[18]

ing spending more than $40 billion (Figure 9).[24] Aerospace product and parts manufacturing and motor vehicle manufacturing also spent tens of billions of dollars on R&D, reflecting their vast sizes and market values. Perhaps surprisingly, R&D for medical equipment and supplies manufacturing is slightly more than $10 billion, although this category accounts only for equipment, supplies, and implants for medical, dental, surgical, and ophthalmic areas. Many NAICS

Table 5. Sales revenues for select companies in the refractories sector

Company	Location	Sales, $M	Recency	Notes
HarbisonWalker Intl	U.S.	500–1,000	June 2016	Formerly known as ANH Refractories Co, the company rebranded itself in January 2015.
RHI AG	Austria	1,882	Not available	Proposed merger with Magnesita Refratarios S/A in 2017 to form RHI Magnesita.
Minerals Technologies Inc	U.S.	1,798	May 2016	
• Minteq International Inc	U.S.	303	September 2015	Parent company is Minerals Technologies Inc.
Imerys S.A.	France	1,374	October 2016	
C-E Minerals Inc	U.S.	355	August 2015	A subsidiary of Imerys.
Magnesita Refratarios S/A	Brazil	1,284	April 2016	Proposed merger with RHI AG in 2017 to form RHI Magnesita.
POSCO Chemtech Co Ltd	South Korea	1,228		Parent company is POSCO.
GrafTech International Ltd	U.S.	1,085	April 2016	Parent company is Brookfield Asset Management Inc.
Krosaki Harima Corp	Japan	984	July 2015	
Shinagawa Refractories Co Ltd	Japan	924	Not available	
• Isolite Insulating Products Co Ltd	Japan	122	February 2016	Parent company is Shinagawa Refractories Co Ltd.
Saint-Gobain Ceramics & Plastics Inc	U.S.	845	July 2015	Parent company is Saint-Gobain Abrasives, one of 14 subsidiaries of the High Performance Materials segment of Compagnie de Saint-Gobain.
• Corhart Refractories Corp	U.S.	103	March 2015	Parent company is Saint-Gobain Ceramics & Plastics.
Morgan Thermal Ceramics	U.K.	484	December 2015	Parent company is Morgan Advanced Materials.
Refratechnik Holding GmbH	Germany	446	Not available	Parent company is Alexander–Tutsek–Stiftung.
Unifrax I LLC	U.S.	438	May 2016	Parent company is American Securities LLC.
Chosun Refractories Co Ltd	South Korea	410	Not available	
Korea Refractories Co Ltd	South Korea	243	September 2014	
Almatis GmbH	Germany	230	December 2015	Parent company is Almatis Holdings GmbH.
Goodwin PLC	U.K.	187	July 2016	
Yotai Refractories Co Ltd	Japan	183	January 2015	
Resco Products Inc	U.S.	182	May 2016	
CFS Group Inc	Canada	119	December 2014	Parent company is Ajawak Investments Ltd.
Allied Mineral Products Inc	U.S.	96	August 2015	
Mino Ceramic Co Ltd	Japan	85	August 2016	
Nippon Crucible Co Ltd	Japan	68	Not available	
Magneco/Metrel Inc	U.S.	66	Jun 2016	
Alsey Refractories Co	U.S.	55	Not available	
Riverside Refractories	U.S.	52	Not available	Parent company is Riverside Clay Co.
Plibrico Co LLC	U.S.	35	Not available	
Minco Inc	U.S.	30	October 2015	Parent company is Ceradyne, a 3M Co.
Zircoa Inc	U.S.	24	November 2015	
Christy Refractories	U.S.	22	Not available	Parent company is O'Brien Industrial Holdings LLC.
Reno Refractories	U.S.	16	Not available	

Data are from Mergent Intellect, formerly Dun & Bradstreet Million Dollar Database (accessed 9/27/2016), private communications, and company websites [www.imerys.com/scopi/Group/ImerysCom/imeryscom.nsf/pagesref/REBA-A9LL9Z/Sfile/RA_Imerys_2015_VA.pdf (accessed 10/31/16; currency conversion calculated 10/31/16); www.morganadvancedmaterials.com/en-gb/investors/financial-highlights/divisional-performance/ (accessed 10/4/16)].

industry codes cross-reference with other coding areas, indicating that the coding divisions imperfectly divide markets.

In addition to R&D dollars spent within industry, government allocation of federal R&D spending is another metric to examine the health of particular sectors. On September 30, 2016, the United States Congress passed a continuing resolution through December 9 to delay definitive FY 2017 spending decisions until after the November presidential election.[25]

The Obama Administration released its R&D budget proposal for FY 2017 in February, highlighting the need to prioritize funds to further clean energy and climate initiatives. However, increased spending did not span all science-related programs. Agencies including NSF received limited discretionary increases, and the plan recommends that billions of dollars be slashed from National Institutes of Health (NIH) and National Aeronautics and Space Administration (NASA) budgets.

Staring down the barrel of the current appropriations cycle, President Obama and Congress did not have much fiscal latitude. In its recent budget analysis, American Association for the Advancement of Science (AAAS)[26] reports in a recent FY 2017 appropriation summary that "discretionary spending—the part of the budget adjusted annually by appropriators, and the source of most federal science funding—was slated to be held flat at $1.07 trillion, under the second and final year of the Bipartisan Budget Act."

Science and technology agencies currently face an uncertain budgetary future while Congress hashes out federal spending details from now through the end of the year. Although the financial outlook appears hazy, AAAS reports that with a "complete set of twelve appropriations bills already through committee, and appropriators' decisions so far will factor into omnibus negotiations later."

But, according to the latest AAAS estimates, the House and Senate would provide moderate increases to federal R&D overall in FY 2017—the House would provide a $3.1 billion or 2.1% increase for R&D above FY 2016 levels, while the Senate would provide a $4.7 billion or 3.2% increase. Both amounts would represent real-dollar increases given at a 1.8% rate of inflation—which would actually outpace spending levels outlined in Obama's budget proposal.

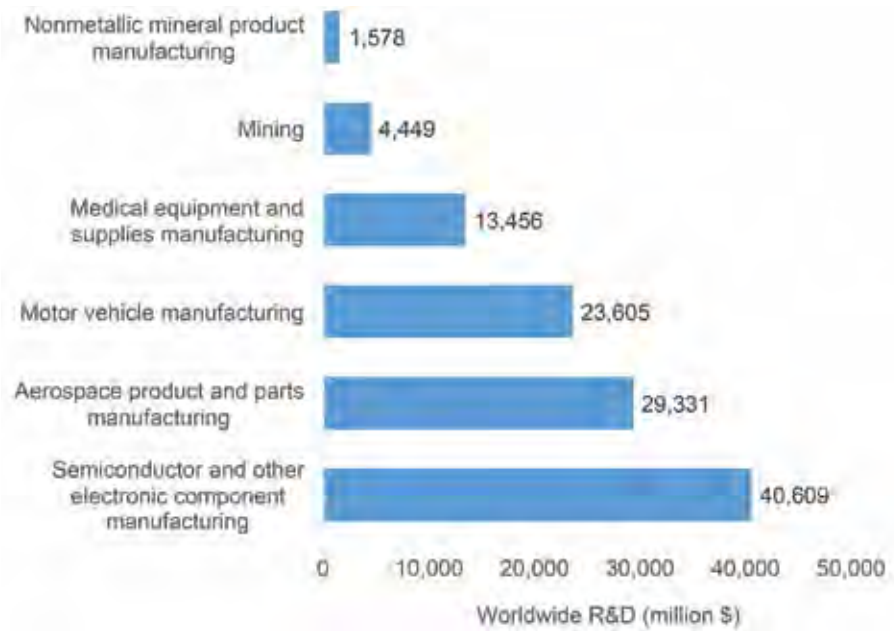


Figure 9. Dollars spent on R&D at worldwide businesses in 2013. Data are from the 2013 Business Research and Development and Innovation Survey.

Table 6 presents a high-level two-year snapshot of funding for some of the largest science agencies from FY 2015 to FY 2017, including the numbers proposed in Obama's FY 2017 R&D budget, according to AAAS.[27]

Clean energy and environmental research get top billing. This includes the Department of Energy's programs. Obama's budget plan requests $16.8 billion for clean energy research and renewable energy programs—the highest increase in federal R&D spending—up 15.07% from FY 2016. Interior and environment R&D spending, which includes the Environmental Protection Agency's programs and initiatives, comes in second with a request for $2.1 billion—up 5.0% from FY 2016.

More money for national defense also is a priority. This includes the Department of Defense (DOD) science and technology initiatives. The Obama administration requests $73.6 billion for DOD science and technology R&D in FY 2017—up 1.9% from FY 2016.

Labor, health, and human services, and education could take a hit. This

Table 6. Federal R&D funding for science and health programs (including agencies)
FY 2015–FY 2017 snapshot (current AAAS estimates of budget)

Department/agency	FY 2015 actual (billion $)	FY 2016 estimates (billion $)	FY 2017 Obama request (billion $)	Change FY 2016–FY 2017	
				Billion $	%
Energy and water Includes DOE	14.5	14.6	16.8	2.2	15.07
Interior and environment Includes EPA	2.0	2.0	2.1	0.1	5.0
Defense Includes DOD Science & Technology	66.4	72.2	73.6	1.4	1.9
Labor/HHS/Education Includes NIH	30.4	32.2	31.3	–1.0	-2.8
Commerce/justice/science Includes NSF, NASA, ARPA-E, and NIST	19.0	21.4	20.3	–1.1	-5.14

includes NIH programs. Obama's budget plan requests $31.3 billion for labor, health, and education initiatives—down 2.8% from FY 2016.

Broad cutbacks could be imminent for commerce, justice, and science. This includes programs within the NSF, NASA, Advanced Research Projects Agency-Energy (ARPA-E), and National Institute of Standards and Technology. Obama's budget plan requests $20.3 billion for R&D in these areas—down 5.14% from FY 2016.

According to a fact sheet published in February by the White House,[28] Obama's budget proposal specifically includes $512 million for NSF research in conversion, storage, and distribution of diverse power sources and the science and engineering of energy materials. In July, NSF announced it will invest more than $400 million over the next seven years to support fundamental wireless research to develop platforms for advanced wireless research in support of the White House's Advanced Wireless Research Initiative.[29]

Obama's budget proposal also requests $350 million in Mission Innovation discretionary funding for DOE's ARPA-E, which supports transformational applied clean energy R&D across a wide array of technologies; and $348 million for clean energy research at NASA in revolutionary aircraft technologies and configurations to facilitate development of fuel-efficient, low-carbon-emitting aircraft.

Of course, these numbers are not set in stone. Congress will likely increase R&D spending in fiscal 2017 before year's end, according to AAAS. And Congress is on track to increase federal spending for R&D by at least $3.1 billion in FY 2017 over the previous year, despite the fact that overall federal discretionary spending is slated to remain relatively flat, according to the latest AAAS analysis of federal spending programs. ■

About the authors

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NAICS CODES—WHAT DO THEY MEAN?

The North American Industry Classification System (NAICS) divides business establishments by industry to collect, analyze, and publish statistical data related to the U.S. economy. NAICS was adopted in 1997 to replace the Standard Industrial Classification (SIC) system. Pertinent codes for the ceramic and glass industries, including selected relevant end-use industries, are described below.

327—Nonmetallic mineral product manufacturing
Includes establishments that manufacture brick, refractory, ceramic, glass, cement, concrete, lime, gypsum, and other nonmetallic minerals and their respective products. This general classification is further broken down into more specific subsectors.

> **3271—Clay product and refractory manufacturing**
> Includes establishments engaged in forming or processing pottery, ceramics, clay or ceramic plumbing fixtures, clay or ceramic electrical fixtures, clay and nonclay refractories, ceramic tile, structural clay tile, brick, and other structural clay building materials.
>
> **3272—Glass and glass product manufacturing**
> Includes establishments that manufacture glass and glass products, including flat glass, pressed and blown glass and glassware, and glass containers.
>
> **3273—Cement and concrete product manufacturing**
> Includes establishments that manufacture cement; ready-mix concrete; concrete pipe, brick, and block; and other concrete products.
>
> **3274—Lime and gypsum product manufacturing**
> Includes establishments that manufacture lime from limestone, dolomitic limestone, or other calcareous materials, such as coral, chalk, and shells; and companies that manufacture gypsum products, such as wallboard, plaster, plasterboard, molding, ornamental moldings, statuary, and architectural plaster work.

334—Computer and electronic product manufacturing
Includes establishments that manufacture computers, computer peripherals, communications equipment, and similar electronic products; and establishments that manufacture components for such products.

335—Electrical equipment, appliance, and component manufacturing
Broadly includes establishments that manufacture products that generate, distribute, and use electrical power. This includes establishments that produce electric lamp bulbs, lighting fixtures, and parts; small and major electrical appliances and parts; electric motors, generators, transformers, and switchgear apparatus; and devices for storing electrical power (e.g., batteries), for transmitting electricity (e.g., insulated wire), and wiring devices.

336—Transportation equipment manufacturing
Broadly includes establishments that manufacture equipment that transports people and goods. This includes establishments that manufacture equipment for road, rail, air, and water transportation, including operations that process metal or plastic parts into components and finished products and operations that assemble components into finished products.

339—Miscellaneous manufacturing
Includes industries that manufacture diverse products that do not readily fit into other NAICS manufacturing subsectors, such as establishments that manufacture medical equipment and supplies, jewelry, sporting goods, toys, and office supplies.

ceramics expo

Cleveland, OH

Advancing the use and adoption of technical ceramic and glass materials and technologies

By Adam Moore

The third annual Ceramics Expo returns to Cleveland, Ohio, April 25–27, 2017, for the ultimate performance—a free-to-attend exhibition of everything new in the world of manufacturing and engineering for ceramic technologies and materials.

Following rapid industry developments in various user segments, Ceramics Expo 2017 again will be setting the agenda as the progressive hub for the industry. "We see a resurgence of interest in ceramics, and the Cleveland show is growing strongly and creating a real buzz in the industry," says Alan Rae, a veteran in the field of technical ceramics and current executive director of IncubatorWorks (Corning, N.Y.), which nurtures the development of entrepreneurial companies. "Once again, there is a great venue to meet with colleagues and new contacts in the ceramic industry."

Credit: ACerS

Ceramics Expo exhibitors will reveal all the burgeoning technologies behind novel, high-performance, precisely engineered components that are proving invaluable in many manufacturing sectors. The exhibition will present a wide offering, with everything from raw materials, preparation and processing equipment, advanced forming technologies, drying and conditioning, and energy-efficient firing and sintering to technical ceramic components, refractories, finishing, testing and analysis, and logistics.

In particular, this established, dynamic, and all-inclusive event aims to expand the knowledge base for senior executives, production controllers, quality managers, design engineers, materials scientists, and researchers. Ceramics Expo directly caters to the needs of key end-user industries, such as automotive, aerospace, medical, electronics, defense, energy, and environmental technologies.

Technical ceramics play a central role throughout the exhibit space, and many of the world's leading manufacturers are already preparing for groundbreaking presentations—including names such as **CoorsTek**, **Morgan Advanced Materials**, **Saint-Gobain**, **AOKEROLA**, **CeramTec**,

Save the date April 25 – 27, 2017!

YJC, **McDanel Advanced Ceramic Technologies**, **Corning**, **Blasch**, **Akron Porcelain**, **Materion Ceramics**, and **IPS Ceramics**. The whole gamut of ceramic and glass materials, from alumina to zirconia, will be featured, and visitors will find a smart materials solution for myriad complex applications—or someone very keen to come up with one!

For example, sponsor and exhibitor **Morgan Advanced Materials** (Berkshire, United Kingdom) has modified one of its innovative core processes to optimize microstructural control and enable enhanced machining. Morgan has reimagined its popular soft and hard piezoelectric ceramic materials to create high-density variants, which comprise grain sizes of 2–4 μm and pore diameters of less than 3 μm.

Florence Godfrin, materials and applications engineer for Morgan, comments on the importance of this material innovation: "Like many of our material innovations, our defect-free PZT is a direct result of a real customer need, initiated back in 2013 when we were tasked with producing a PZT product that had high density and low porosity. From there, we used the same core manufacturing process to develop and research other material improvements across our soft and hard piezoelectric ceramics."

"The distinct characteristics of this new PZT material offer improved machinability and increased mechanical strength over conventional materials. This is especially beneficial for actuator applications, in which our fine-grained, defect-free PZT can deliver improved reliability, higher driving fields, and lower driving voltages," Godfrin says.

"At this stage, we have manufactured a number of different small components using the new defect-free material, with a number of larger products set to benefit from the innovation in due course—which will increase piezoelectric properties as well as coupling of the parts to deliver real benefits in sonar and high-power applications."

Entering the exhibition hall, Ceramics Expo visitors will see the **CoorsTek** (Golden, Colo.) exhibit, which is set to showcase a unique range of products and solutions. CoorsTek recently announced a new process using a novel ceramic membrane to make direct, non-oxidative conversion of a gas to liquids possible for the first time—reducing cost, eliminating multiple process steps, and avoiding carbon dioxide emissions. The resulting aromatic precursors are source chemicals for insulation materials, plastics, textiles, and jet fuel, among other valuable products.

Direct activation of methane, the main component of biogas and natural gas, has been a key goal of the hydrocarbon research community for decades. "Consider the scale of the oil, gas, and petrochemicals industry today," says Jose Serra, professor with Instituto de Tecnología Química in Valencia, Spain, and leader of one of the scientific teams working alongside CoorsTek Membrane Sciences. "With new ceramic membrane reactors to make fuels and chemicals from natural gas instead of crude oil, the whole hydrocarbon value chain can become significantly less expensive, cleaner, and leaner."

"By using a ceramic membrane that simultaneously removes hydrogen and injects oxygen, we have been able to make liquid hydrocarbons directly from methane in a one-step process. As a bonus, the process also generates a high-purity hydrogen stream as a byproduct," Serra explains. "At a macro level it is really very simple—inexpensive, abundant gas goes in and valuable liquid comes out through a clean, inexpensive process. At a nanochemistry level, however, where molecules interact with catalyst and membrane at a temperature around 700°C, there were many factors to engineer and control in order to render just the specific molecules needed to make the new process work."

Blasch Precision Ceramics (Albany, N.Y.), returning for the third year, recently launched Verkapse, a turnkey solution consisting of polyurethane-encased ceramic for

applications involving hydrocyclone separators and other mineral-processing equipment. Until now, this encapsulation step was completed by a subcontractor, using inserts sourced from ceramic manufacturers.

"Leveraging Blasch's decades of molding experience, coupled with significant advancements in CNC pattern making, the Verkapse process can deliver single-sourced, completely encapsulated assemblies in a few short weeks," says Jeff Bolebruch, vice president of sales at Blasch. "Our process has reduced cost and lead time for our customers while providing a product with greater overall durability and reliability."

The mounting enthusiasm for an event that is high-tech but hands-on is a response to bringing all the right people together in an atmosphere conducive to fostering great relationships—and subsequently producing the right results. Bo-Kuai Lai, materials scientist at Lake Shore Cryotronics (Westerville, Ohio), gives top marks for the straightforward registration process, venue, access, and navigation inside Cleveland's I-X Center. "Exhibitors presented a wide spectrum of the ceramic industry, and I was able to find several companies that are related to my work," Lai says. "The expo helped me find a good ceramic substrate company, and we recently placed an

EXHIBITOR LIST Subject to change

Correct as of 11/10/2016

Company	Booth
3DCeram	643
Aadvanced Machinery Inc	618
Acrow Machinery Mfg Co Ltd	912
AdValue Technology LLC	816
Advanced Abrasives Corp	1222
Advanced Energy Industries Inc	502
Advanced Glass & Ceramics	237
Advanced Superabrasives Inc	433
Akron Porcelain & Plastics Co	528
Alfred University	311
Allied High Tech Products Inc	831
Allied Powers LLC	648
Almatis Inc	224
Alteo Gardanne	328
AluChem Inc	316
AlzChem AG	228
Applied Ceramics Inc	114
Applied Test Systems Inc	106
Astral Material Industrial Co Ltd	708
Aveka	438
AVS Inc	205
B&P Process Equipment and Systems LLC	942
Baikowski International	122
Beckman Coulter	800
Bhalla Chemical Works Pvt Ltd	432
Blasch Precision Ceramics Inc	334
Boca Bearing Co	1031
Bullen Ultrasonics Inc	241
BYK Additives and Instruments	104
CCEWOOL Thermomax Inc	908
Centerline Technologies	435
Centorr Vacuum Industries Inc	825
Ceramco Inc	409
Ceramdis Advanced Ceramics	242
Ceramic Applications	642
Ceramic Industry	824
CeramTec GMBH	923
Cerinnov Inc	219
China Changsha Zhonglong Chemical Co Ltd	802
Cleveland Electric Laboratories	500
Cleveland Vibrator Co	201
CM Furnaces Inc	430
Compass Wire Cloth	335
Control Concepts Inc	336
CoorsTek Inc	200
Corning Inc	532
Croda Inc	130
Crystex Composites LLC	410
Custom Processing Services	141
Daiichi Jitsugyo (America) Inc	124
Dalian Zhengxing Abrasive Co Ltd	501
DCM Tech	1029
Deltech Inc	617
DENKA Corp	830
Diacut Inc	943
Dorst America Inc	429
Du-Co Ceramics Co	1123
E.C. Kitzel	716
Edward Orton Jr Ceramic Foundation	213
Eirich Machines Inc	118
Elan Technology	517
Elkem Materials Inc	324
Engineered Ceramics	909
Engis Corp	917
ESL ElectroScience	339
ETiMINE USA Inc	341
Eurotherm by Schneider-Electric	930
ExOne	326
Ferro Corp	808
Ferro-Ceramic Grinding Inc	112
FlackTek Inc	240
Foam Expo	934
Formatec Ceramics	136
Fritsch USA Inc	422
Gasbarre Products Inc	319
Gasser & Sons Inc	834
GeoCorp Inc	622
Glass Manufacturing Industry Council	312
Glen Mills Inc	416
Global - Pak Inc	417
Goodfellow Corp	722
H.C. Starck	230
Haiku Tech Inc	538
Hammond Group Inc	729
Harper International Corp	530
Harrop Industries Inc	216
HGR Industrial Surplus	905
Hitachi High Technologies America Inc	208
Honeywell Thermal Solutions	608
Horiba Instruments Inc	436
Houghton International	717
Hysitron	143
IBU-tec Advanced Materials AG	333
Imerys North America Ceramics	524
Inmatec Technologies GmbH	134
Innovnano	340
Insaco Inc	129
IPS Ceramics	439
IRD Ceramics	137
Iwatani Corp	728
Kaolin EAD	819
Keith Co	823

order with it with confidence."

Attendees also are set for another compelling Conference @ Ceramics Expo, an event establishing itself as a vibrant and dynamic platform for the exchange of ideas. Attendees will hear from experts with a deep knowledge of this industry; pick up on the latest ideas and developments in materials, manufacturing, and applications; and take away with them a toolbox fit for future strategies.

There already is great interest in next year's twin-track sessions, which again will be free to attend, making the experience fully accessible for everyone. "I think the free attendance gives it an egalitarian feel—I saw an 'unemployed ceramics engineer' and thought that was a great way to network and interact without the job-fair stigma," comments George Bedinger, a mineral commodity specialist at the United States Geological Survey's National Minerals Information Center (Reston, Va.).

The at-a-glance Conference @ Ceramics Expo agenda will be released soon. Visit ceramicsexpousa.com for the initial speaker roster and agenda outline.

Ceramics Expo 2017 is a must-attend event that will reflect the creativity, expertise, and optimism that abound in the ceramics and allied industries. There will be more than 300 exhibitors, and well in excess of 3,500 visitors are expected. **Preregister for free now at ceramicsexpousa.com/visit/register.** ■

Interested in being involved in CEX 2017? Contact event director Adam Moore to discuss exhibiting, sponsoring, or attending at adam.moore@smartershows.com

Company	Booth
Keysight Technologies Inc	829
Kläger Spritzguß GmbH & Co KG	108
Lancaster Products	401
Lapmaster International LLC	836
Lhoist - Spinks Clay Company	318
Linseis Inc	236
Lithoz GmbH	329
Loomis Products	522
LouwersHanique BV/LLC	128
Material Complexions Inc	135
Materion Ceramics Inc	443
McDanel Advanced Ceramic Technologies LLC	638
MEL Chemicals	616
Microdiamant USA Inc	938
Micromeritics Instrument Corp	235
Midwestern Industries	928
MillenniTEK	431
Mindrum Precision Inc	140
MK Import/Export Inc	607
MoistTech Corp	331
Morgan Advanced Materials	325
Mo-Sci Corp	218
Nabaltec AG	229
Nabertherm	142
Nanmac Corp	1011
Nanoe	304
Nanoker Research SL	428
Nanoscience Instruments Inc	919
Netzsch Instruments NA LLC	100
Netzsch Premier Technologies	548
Ningbo Cathay Pacific Ceramics Co Ltd	408
NSL Analytical Services Inc	337
Nu-Star Inc	227
Nutec Bickley	518
Nyacol Nano Technologies Inc	924
OptiPro Systems	449
Orbis Machinery LLC	822
Orbite Technologies Inc	110
Panalytical	713
Paul O. Abbe	440 (&442)
PCL Ceramics Ltd	649
Piezo Kinetics Inc	719
Powder Processing & Technology LLC	111
PowderPro AB	126
Precision Ceramics USA	127
PremaTech Advanced Ceramics	509
Promat Inc	732
PSC Inc	434
Qingdao Terio Corp	508
Qingdao Western Coast Advanced Materials Co Ltd	309
Quantachrome Instruments	512
Raymond Bartlett Snow, Arvos Group	516
Regal Diamond Products	609
Resodyn Acoustic Mixers	700
Rigaku Americas	413
Robocasting Enterprises LLC	718
Saint Gobain Boron Nitride	1025
Saint-Gobain Ceramics	712
Sandvik Heating Technology	812
Sauereisen	519
Schott North America Inc	813
Seneca Ceramics	724
Sequoia Scientific Inc	641
Setaram Inc	510
Showa Denko America Inc	911
Sigma Advanced Materials	818
Superior Graphite Co	419
Superior Technical Ceramics	418
Swindell Dressler International	232
TA Instruments - Water Corp LLC	210
'Team by SAMCI' Laeis GmbH	619
TevTech LLC	343
The American Ceramic Society*	308
The City of Stoke-on-Trent	1022
The Young Industries Inc	300
Thermaltek Inc	317
Thermcraft Inc	411
Thermo Fisher Scientific Inc	702
Toto USA Inc	843
Trans-Tech Inc	726
Treibacher Industrie AG	817
TRS Technologies	828
Ultra Electronics - Furnace Parts	805
Unifair Exhibition Service Co Ltd	1128
Unimin Corp	225
Union Process Inc	703
Universal Laser Systems Inc	809
US Stoneware	601
Vac-U-Max	835
Vanderbilt Minerals LLC	131
Verder Scientific Inc	922
Viridis3D	840
Vorti-Siv/MM Industries Inc	837
Warner Power	542
Washington Mills Electro Minerals Corp	223
Werner G. Smith Inc	116
Xieta International S.L.	342
YJC Co Ltd	801
Zhengzhou Sunrise Refractory Co Ltd	505
ZIRCAR Ceramics Inc	322
Zircoa Inc	412

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PLENARY SPEAKERS

Sossina Haile

Walter P. Murphy professor of materials science and engineering, Northwestern University

Thermochemistry of redox active oxides and its relevance to solar fuel generation

Neil Alford

Professor of physical electronics and thin-film materials, vice-dean (research) faculty of engineering, Imperial College London

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TENTATIVE SCHEDULE

Current as of October 14, 2016

Tuesday, January 17, 2017

Conference registration	5 – 6:30 p.m.

Wednesday, January 18, 2017

Conference registration	7:30 a.m. – 6 p.m.
Plenary session I – Sossina Haile	8:30 – 9:30 a.m.
Coffee break	9:30 – 10 a.m.
Concurrent technical sessions	10 a.m. – 12:30 p.m.
Poster session set-up	12 – 5:00 p.m.
Lunch on own	12:30 – 2 p.m.
Student award finalist presentations	12:45 – 1:50 p.m.
Concurrent technical sessions	2 – 5:30 p.m.
Coffee break	3:30 – 4 p.m.
Poster session and reception	5:30 – 7:30 p.m.
Basic Science Division tutorial	7:45 – 9:45 p.m.

Thursday, January 19, 2017

Conference registration	7:30 a.m. – 6 p.m.
Plenary session II – Neil Alford	8:30 – 9:30 a.m.
Coffee break	9:30 – 10 a.m.
Concurrent technical sessions	10 a.m. – 12:30 p.m.
Lunch on own	12:30 – 2 p.m.
Student award finalist presentations	12:45 – 1:45 p.m.
Concurrent technical sessions	2 – 5:30 p.m.
Coffee break	3:30 – 4 p.m.
Young Professionals reception	5:30 – 6:30 p.m.
Conference dinner	7 – 9 p.m.

Friday, January 20, 2017

Conference registration	7:30 a.m. – 5:30 p.m.
Concurrent technical sessions	8:30 a.m. – 12:30 p.m.
Coffee break	9:30 – 10 a.m.
Lunch on own	12:30 – 2 p.m.
Concurrent technical sessions	2 – 5:30 p.m.
Coffee break	3:30 – 4 p.m.
Failure: The greatest teacher	5:45 – 6:45 p.m.

WINTER WORKSHOP

ACerS Winter Workshop is designed for ceramic and glass students and young professionals from around the world. The workshop provides a combination of technical and professional development sessions and outstanding networking opportunities and concludes with a tour of the Kennedy Space Center. See **ceramics.org/winter-workshop** for more details.

FAILURE: THE GREATEST TEACHER

The vast majority of scientific literature and conference talks report positive results, but there is a lot to be learned from negative results and missteps as well. After the "successful" part of the meeting closes, come hear recognized leaders in the field discuss failure—and perhaps recount some of their most spectacular learning experiences—during a frank and friendly discussion in a relaxed atmosphere. Speakers and audience members alike are encouraged to check their egos at the door for this event that has turned into an EMA highlight. In addition to highlighted failures, this year we also will include contributed vignettes on failure and lessons from experience. If you would like to speak at this symposium, please contact Geoff Brennecka (geoff.brennecka@mines.edu).

TECHNICAL SESSIONS

S1: Advanced electronic materials: Processing, structures, properties, and applications

S2: Advanced processing for electronic and electrochemical systems: Crystals, films, and devices

S3: Ceramic photonic materials and applications

S4: Computational design of electronic materials

S5: Energy sustainable optoelectronics and magnetoelectronics

S6: Fundamentals to applications for the use of thermal energy for power generation and refrigeration

S7: In situ experiments of microstructure evolution and properties

S8: Interfaces and surfaces in energy-related ceramic materials

S9: Interfaces in microstructural evolution: Structure, properties, anisotropy, and motion

S10: Interfacial phenomena in multifunctional heterostructures: From theory to transport processes

S11: Ion-conducting ceramics

S12: 5G materials for the millimeter-wave revolution

S13: Mesoscale phenomena in ceramic materials, nanostructures, and microstructures

S14: Multifunctional nanocomposites

S15: Superconducting materials and applications

S16: Failure: The greatest teacher

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AWARD AND PLENARY SPEAKERS

JAMES I. MUELLER AWARD

Kriven

Waltraud Kriven, professor, University of Illinois at Urbana-Champaign

Geopolymers: Structural inorganic polymers

BRIDGE BUILDING AWARD

Sajgalik

Pavol Sajgalik, president, Slovak Academy of Sciences, and department head, ceramic department, Institute of Inorganic Chemistry, Slovak Academy of Sciences, Bratislava, Slovakia

Additive-free, hot-pressed silicon carbide ceramics—A material with exceptional properties

PLENARY SPEAKER

Webster

Thomas J. Webster, chair and professor of chemical engineering, Northeastern University

Fifteen years of commercializing ceramic medical devices using nanotechnology

PLENARY SPEAKER

Chazono

Hirokazu Chazono, senior operating officer of inductor business, Taiyo Yuden Co. Ltd., Japan

MLCC/inductor trends and technological evolution

ECD GLOBAL YOUNG INVESTIGATOR AWARD

Liu

Gang Liu, Shenyang National Laboratory for Materials Science, China

Multiscale designing of solar-driven photocatalysts

2017 Program Chair

Jingyang Wang

Shenyang National Laboratory for Materials Science Institute of Metal Research, Chinese Academy of Sciences, China

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MECHANICAL PROPERTIES OF CERAMICS AND GLASS SHORT COURSE

JANUARY 26, 2017 | 8:30 A.M. – 4:30 P.M
JANUARY 27, 2017 | 8:30 A.M. – 4 P.M.
LOCATION: HILTON DAYTONA BEACH RESORT AND OCEAN CENTER
INSTRUCTORS: George D. Quinn, NIST, and Richard C. Bradt, University of Alabama

Make the most of your time at ICACC by registering for this two-day course that addresses the mechanical properties of ceramics and glasses for elastic properties, strength measurements, fracture parameters, and indentation hardness. For each of these topical areas, the fundamentals of the properties are discussed, explained, and related to the structure and crystal chemistry of the materials and their microstructure. Standard test methods are covered. Learn from industry experts with more than 80 years of combined experience. Register and get more information at ceramics.org/icacc2017shortcourse.

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EXHIBITION INFORMATION

Showcase your organization at the premier international advanced ceramics and composites expo. Connect with decision makers and influencers in industry, government, and research and development fields. ICACC17 is your destination to collaborate with business executives, entrepreneurs, engineers, and R&D leaders around the world.

Exhibit hours: Tuesday, January 24, 5 – 8 p.m.
Wednesday, January 25, 5 – 7:30 p.m.

Exhibit location: Ocean Center Arena, 101 North Atlantic Avenue, Daytona Beach, FL 32118

Exhibit space is filling up fast. To reserve your booth, visit ceramics.org/icacc2017 or contact Mona Thiel at 614-794-5834 or mthiel@ceramics.org.

Exhibitor	Booth
AdValue Technology	205
Alfred University	315
AVS	307
BCC Research	301
Centorr	200
CM Furnaces	311
C-Therm	220
Gasbarre (PTX)	207
H.C. Stark	305
Haiku Tech	214
Harper International Corp.	317
J. Rettenmaier USA	201
Lithoz GmbH	107
MEL Chemicals	313
Microtrac	306
Nanoscience Instruments	202
Netzsch Instruments	300
NGS Advanced Fibers	204
Noritake	302
Oxy-Gon Industries Inc.	320
Reserved	216
Sonoscan	221
Superior Graphite	203
TA Instruments	210
Tev Tech	212
Thermal Wave	321
Thermcraft Inc.	303
Verder Scientific (Carbolite)	206
Zircar Ceramics	304

SCHEDULE OF EVENTS

Sunday, January 22	
Conference registration	2 – 7 p.m.
Welcome reception at Hilton	5:30 – 7 p.m.
Monday, January 23	
Conference registration	7 a.m. – 6 p.m.
Opening awards ceremony and plenary session	8:30 a.m. – Noon
Companion coffee	9 – 10:30 a.m.
Lunch on own	Noon – 1:20 p.m.
Concurrent technical sessions	1:30 – 5:30. p.m.
Young Professional Network, Global Graduate Researcher Network student mixer	7:30 – 9 p.m.
Tuesday, January 24	
Conference registration	7:30 a.m. – 6 p.m.
Concurrent technical sessions	8:30 a.m. – Noon
Lunch on own	Noon – 1:20 p.m.
Concurrent technical sessions	1:30 – 5 p.m.
Exhibits and poster session A, including reception	5 – 8 p.m.
Wednesday, January 25	
Conference registration	7:30 a.m. – 5:30 p.m.
Concurrent technical sessions	8:30 a.m. – Noon
Lunch on own	Noon – 1:20 p.m.
Concurrent technical sessions	1:30 – 5 p.m.
Exhibits and poster session B, including reception	5 – 7:30 p.m.
Thursday, January 26	
Conference registration	7:30 a.m. – 6 p.m.
Concurrent technical sessions	8:30 a.m. – Noon
Mechanical Properties of Ceramics and Glass short course (Day 1)	8:30 a.m. – 4:30 p.m.
Lunch on own	Noon – 1:20 p.m.
Concurrent technical sessions	1:30 – 5:30 p.m.
Friday, January 27	
Conference registration	8 a.m. – Noon
Concurrent technical sessions	8:30 a.m. – Noon
Mechanical Properties of Ceramics and Glass short course (Day 2)	8:30 a.m. – 4 p.m.

Current as of October 14, 2016

OFFICIAL NEWS SOURCES

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Calendar of events

January 2017

18–20 EMA 2017: ACerS Electronic Materials and Applications – DoubleTree by Hilton Orlando Sea World, Orlando, Fla.; www.ceramics.org/ema2017

18–22 ACerS Winter Workshop 2017 – DoubleTree by Hilton Orlando Sea World, Orlando, Fla.; www.ceramics.org/winter-workshop

22–27 ICACC'17: 41st Int'l Conference and Expo on Advanced Ceramics and Composites – Hilton Daytona Beach Resort/Ocean Walk Village, Daytona Beach, Fla.; www.ceramics.org/icacc2017

February 2017

20–24 Materials Challenges in Alternative and Renewable Energy – Jeju, Korea; www.ceramics.org/mcare2017

March 2017

29–30 53rd Annual St. Louis Section/RCD Meeting – Hilton St. Louis Airport, St. Louis, Mo.; www.ceramics.org/sections/st-louis-section

April 2017

24–25 6th Ceramic Business and Leadership Summit – I-X Center, Cleveland, Ohio; www.ceramics.org/meetings/cls2017

25–27 Ceramics Expo 2017 – I-X Center, Cleveland, Ohio; www.ceramicsexpousa.com

May 2017

21–26 12th Pacific Rim Conference on Ceramic and Glass Technology, including Glass & Optical Materials Division Meeting – Hilton Waikoloa Village, Waikoloa, Hawaii; www.ceramics.org/meetings/pacrim12

July 2017

4–7 6th European PEFC & H_2 Forum: 21st Conference in Series with Tutorial, Exhibition, and Application Market – Lucerne, Switzerland; www.EFCF.com

24–28 9th Int'l Conference on Borate Glasses, Crystals, and Melts; Int'l Conference on Phosphate Glasses – Oxford, U.K.; www.sgt.org

Dates in **RED** denote new entry in this issue.

Entries in **BLUE** denote ACerS events.

➨ denotes meetings that ACerS cosponsors, endorses, or otherwise cooperates in organizing.

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Statement of Ownership

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	Avg. each issue during previous 12 months	Actual no. of single issue nearest filing date
A. Total number of copies (net press run)	8,370	8,294
B. Paid and/or requested circulation		
1. Paid/requested outside-county mail subscriptions	3,385	3,352
2. Paid in-county subscriptions	none	none
3. Sales through dealers and carriers, street vendors, counter sales and other non-USPS paid distribution	2,011	1,914
4. Other classes mailed through the USPS	none	none
C. Total paid and/or requested circulation	5,396	5,266
D. Free distribution by mail (samples, complimentary and other free)		
1. Outside-county	2,264	2,575
2. In-county	none	none
3. Other classes mailed through the USPS	none	none
E. Free distribution outside the mail (carriers or other means)	532	245
F. Total free distribution	2,796	2,820
G. Total distribution	8,192	8,086
H. Copies not distributed	36	40
I. **Total**	8,228	8,126
J. Percent paid and/or requested circulation	65.87%	65.12%

deciphering the discipline

A regular column offering the student perspective of the next generation of ceramic and glass scientists, organized by the ACerS Presidents Council of Student Advisors.

Jeroen Deijkers
Guest columnist

Oxidation in thermal/environmental barrier coatings—A self-healing paradox?

When considering self-healing materials, the first material that comes to mind is a polymer. Polymers' intrinsic healing capabilities and the ease of combining polymers with extrinsic healing methods have been a focus of materials research for many years. But what about self-healing in other materials?

One of the main applications of self-healing materials is to heal cracking, which is a prevalent problem in ceramic materials, such as thermal barrier coatings (TBCs) used in turbine engines. Thermal cycling eventually results in delamination of TBCs, limiting the lifetime of these coatings. Ceramics do not have the intrinsic healing capabilities of polymers. So, recovering bonds in ceramics usually requires high temperatures and long times. Developing self-healing capabilities in ceramics could, therefore, greatly benefit these materials and their high-temperature applications.

During my M.Sc. studies at Delft University of Technology in the Netherlands, I was attracted to the concept of self-healing zirconia-based TBCs. For my thesis, I incorporated extrinsic self-healing to TBCs by adding small hollow Al_2O_3 shells filled with $MoSi_2$. Upon breaking of the shells, $MoSi_2$ reacts with air to form SiO_2. This oxidation causes volume expansion, filling the crack with more product than the initially supplied reactant.

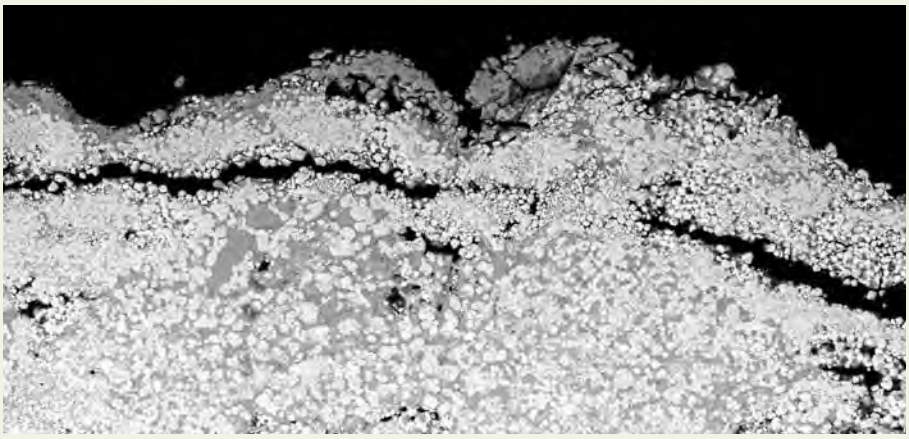
My interest in developing these types of high-temperature materials led me to a graduate student position at the University of Virginia (Charlottesville, Va.). The curious engineer in me gladly accepted an offer to work on coating systems to protect silicon carbide composites. In silicon carbide coating systems, the silicon bond coat oxidizes to SiO_2 (α/β-cristobalite). In this case, however, oxidation is detrimental, because it forms a thermally grown oxide with a high coefficient of thermal expansion, and the thermal stresses generated by the oxide crack the coating.

So, oxidation can be self-healing in some cases, but self-destructive in other situations. Because of these conflicting functions, should self-healing be designated as a material property or should it be defined as a concept to say that a material is designed to have an extended lifetime? I think the latter is true. Oxidation of the silicon bond coat in barrier coatings cannot be avoided, but we can attempt to extend the life of the coating by adding another material to heal cracks that form during thermal cycling.

Currently, adding HfO_2 to silicon seems to be a viable self-healing concept. When silicon oxidizes to SiO_2, it quickly reacts to a stable form of $HfSiO_4$. This material has a coefficient of thermal expansion that is similar to other materials in the coating and substrate, and, when it reacts with the nonpreferential α-cristobalite, it eliminates high thermal stresses. Also, if a crack forms in the coating perpendicular to the coating surface and reaches the silicon bond coat, SiO_2 will form first, followed by formation of stable $HfSiO_4$. This reaction stops cracking and creates an oxygen barrier between the incoming gas flow and underlying substrate.

Using self-healing as a materials concept can allow us to use traditional material systems that we would initially discard because of their short lifespans and, instead, allow us to think of new designs and material composites to obtain our desired goals. It may seem to be a paradox, but an initial weakness may end up giving us a more durable product.

Jeroen Deijkers is a Ph.D. student in materials science and engineering at the University of Virginia and is working on the next generation of environmental barrier coatings. Combining his current studies with his B.Sc. and M.Sc. in aerospace engineering, Deijkers aims to develop novel materials for aircraft and spacecraft in the growing aerospace industry. In his spare time, he enjoys exploring the natural beauty of America—a contrast to the flat, windy, Dutch countryside he grew up in. ■



Credit: Jeroen Deijkers

Micrograph showing an example of self-healing (formation of hafnon (gray) from SiO_2 and HfO_2 (white)) and self-destruction (delamination of the top layer) in a material because of oxidation of silicon.

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BassTech Intl NJ
Empower Materials Inc DE
Fusion Ceramics Inc OH
GV Service Inc NY
Gwent Electronic Materials Ltd UK
Haiku Tech Europe BV
Haiku Tech Inc FL
Hexion Inc OH
LignoTech USA WI
Nyacol Nano Technologies Inc MA
Peter Pugger Manufacturing Inc CA

Polymer Innovations Inc CA **See ad page 41**
Process Engineering Services TX
Promis Industries India
Refractory Minerals Co Inc PA
Shamrock Technologies Inc NJ
Spinks Clay Co TN
Tape Casting Consultants Inc PA
Tape Casting Warehouse Div PA
Tethon 3D NE
Trinity Ceramic Supply Inc TX
Vanderbilt Minerals LLC CT
Vitta Corp CT
Wesbond Corp DE
Zschimmer & Schwarz GA

Colorants
American Chemet Corp IL **See ad page 49**
Arlimin Industries CO
Ceramic Color & Chemical Manufacturing Co PA
Cristal Inc MD
Degussa Corp NJ
Eppler Associates CT
Fusion Ceramics Inc OH
Hefa Rare Earth Canada Co Ltd Canada
Imerys Refractory Minerals GA
Laguna Clay Co CA
Mason Color Works Inc OH
Phoenix Coating Resources Inc FL
Sauereisen Inc PA **See ad page 47**
Wistra France
Wistra GmbH Germany

Conditioners
LignoTech USA WI
Sweco KY
Vanderbilt Minerals LLC CT

Deflocculants
BassTech Intl NJ
Fusion Ceramics Inc OH
GV Service Inc NY
LignoTech USA WI
Spinks Clay Co TN
Tape Casting Consultants Inc PA
Tape Casting Warehouse Div PA
Zschimmer & Schwarz GA

Defoaming Agents
Acme Tech Co China
Arkema Inc PA
Chongqing Acme Tech Co Ltd China
FelCom LLC OR
Momentive Performance Materials Inc NY
Polymer Innovations Inc CA **See ad page 41**
Zschimmer & Schwarz GA

Fillers
Arkema Inc PA
Baikowski Malakoff Inc NC
Dow Corning Corp MI
Fusion Ceramics Inc OH
Hexion Inc OH
Imerys Refractory Minerals GA
Maruwa Ceramic Co Ltd Japan
Maryland Refractories Co OH
Momentive Performance Materials Inc NY
National Lime & Stone Co OH
NYCO Minerals Inc NY
Oglebay Norton Industrial Sands OH
RE Carroll Inc PA
Sauereisen Inc PA **See ad page 47**
Spinks Clay Co TN
Vanderbilt Minerals LLC CT

Flocculants
Hexion Inc OH
Spinks Clay Co TN
Wesbond Corp DE
Zschimmer & Schwarz GA

Fluxes
Denka Corp NY
Fusion Ceramics Inc OH

Foaming Agents
Arkema Inc PA
FelCom LLC OR
Hexion Inc OH
Zschimmer & Schwarz GA

Fungicides
Vanderbilt Minerals LLC CT

Gelling Agents
Active Minerals Intl LLC MD
Sasol North America Inc AZ
Trinity Ceramic Supply Inc TX
Vanderbilt Minerals LLC CT

Glaze Additives
BassTech Intl NJ
Fusion Ceramics Inc OH
GV Service Inc NY
Hexion Inc OH
Vanderbilt Minerals LLC CT
Zschimmer & Schwarz GA

Glaze Hardeners
Fusion Ceramics Inc OH
Vanderbilt Minerals LLC CT

Lubricants
Arkema Inc PA
Boca Bearing Co FL
FelCom LLC OR
Huntsman Corp / Performance Products TX
Kaeser Compressors Inc VA
LignoTech USA WI
Mold Release Products Inc DE
Momentive Performance Materials Inc NY
RE Carroll Inc PA
Renite Co OH
Shamrock Technologies Inc NJ

Spinks Clay Co TN
Superior Graphite Co IL **See ad page 55**
Tape Casting Warehouse Div PA
Zschimmer & Schwarz GA

Mill Additions
Sweco KY

Organometallic Precursors
FelCom LLC OR
Gelest Inc PA
Zibo Guangtong Chemical Co Ltd China

Plasticizers
Arkema Inc PA
Croda DE
Hexion Inc OH
Huntsman Corp / Performance Products TX
LignoTech USA WI
Novomer Inc MA
Polymer Innovations Inc CA **See ad page 41**
Spinks Clay Co TN
Tape Casting Consultants Inc PA
Tape Casting Warehouse Div PA
Zschimmer & Schwarz GA

Polycarbosilane
Gelest Inc PA
Momentive Performance Materials Inc NY
Starfire Systems Inc NY

Refractory Additives
Almatis Inc PA
BassTech Intl NJ
Feldco Intl CA
Fusion Ceramics Inc OH
Innovnano - Advanced Materials SA Portugal
LignoTech USA WI
Promis Industries India
QuantumSphere Inc CA
Refractory Minerals Co Inc PA
Spinks Clay Co TN
Vanderbilt Minerals LLC CT
Zschimmer & Schwarz GA

Release Agents
BassTech Intl NJ
Dow Corning Corp MI
FelCom LLC OR
Hexion Inc OH
Renite Co OH
Shamrock Technologies Inc NJ
Zschimmer & Schwarz GA

Rheological Additives
Croda DE
Degussa Corp NJ
LignoTech USA WI
Polymer Innovations Inc CA **See ad page 41**
Shamrock Technologies Inc NJ
Vanderbilt Minerals LLC CT
Zschimmer & Schwarz GA

Sintering Aids
Amalgamet Canada Canada
Baikowski Malakoff Inc NC
Degussa Corp NJ
Empower Materials Inc DE
Huntsman Corp / Performance Products TX
Nyacol Nano Technologies Inc MA
Polymer Innovations Inc CA **See ad page 41**
Starfire Systems Inc NY

Suspending Agents
Croda DE
Degussa Corp NJ
FelCom LLC OR
Huntsman Corp / Performance Products TX
LignoTech USA WI
Spinks Clay Co TN
Trinity Ceramic Supply Inc TX
Vanderbilt Minerals LLC CT
Vitta Corp CT
Zschimmer & Schwarz GA
ZYP Coatings Inc TN

Tape-Casting Additives
Croda DE
Empower Materials Inc DE

Polymer Innovations Inc CA **See ad page 41**
Promis Industries India
Tape Casting Warehouse Div PA
Zschimmer & Schwarz GA

Thickening Agents
Active Minerals Intl LLC MD
Degussa Corp NJ
Polymer Innovations Inc CA **See ad page 41**
Sasol North America Inc AZ
Spinks Clay Co TN
Vanderbilt Minerals LLC CT

Viscosity Stabilizers
Active Minerals Intl LLC MD
Hexion Inc OH
Norcross Viscosity Controls MI

Wetting Agents
Acme Tech Co China
Arkema Inc PA
Chongqing Acme Tech Co Ltd China
Croda DE
FelCom LLC OR
Polymer Innovations Inc CA **See ad page 41**
Process Engineering Services TX
Zschimmer & Schwarz GA

ADVANCED STRUCTURAL & TECHNICAL CERAMICS

Adhesives
Advanced Superabrasives NV
Aremco Products Inc NY
Arkema Inc PA
CerCo LLC OH
Cotronics Corp NY
Denka Corp NY
FelCom LLC OR
Flexible Ceramics Inc CA
GV Service Inc NY
Hexion Inc OH
Momentive Performance Materials Inc NY
Starfire Systems Inc NY

Alumina Products
Accuratus Corp NJ
AdTech Ceramics TN
AdValue Technology LLC AZ **See ad page 55**
Advanced Ceramic Technology CA
Advanced Ceramics Manufacturing AZ
Advanced Composite Materials LLC SC
Almatis Inc PA
Alteo NA LLC OH
AluChem Inc OH
Aremco Products Inc NY
Associated Ceramics & Technology Inc PA
Astral Material Industrial Co Ltd China
Astro Met Advanced Ceramics Inc OH
B&B Refractories Inc CA
Beijing Cerametek Materials Co Ltd China
Bettini SpA Italy
Bharat Heavy Electricals Ltd India
Blasch Precision Ceramics Inc NY
Bullen OH
Ceramaret SA Switzerland
Ceramco Inc NH
Ceramic Oxide Fabricators Pty Ltd Australia
Ceramic Solutions Inc TX
CeramTec North America Corp SC
CeraNova Corp MA
CerCo LLC OH
Chaozhou Three-Circle Co Ltd China
CoorsTek CO
Custom Processing Services PA
Denka Corp NY
Du-Co Ceramics Co PA
Dynamic Exim Corp India
EBL Products Inc CT
ELE Advanced Ceramics China
Enterprise Personnel CO
ETEC Gesellschaft fuer Technische Keramik GmbH Germany
Federal-Mogul MI
Feldco Intl CA
Ferro Ceramic Grinding Inc MA
Ferrotec Ceramic Products China
Filtros Ltd NY
Friatec AG Germany
HC Starck GmbH Germany
Heany Industries Inc NY
HTI Technologies France
Induceramic Canada
Industrial Ceramic Technology MI
Innalox BV Netherlands
Intl Ceramic Engineering MA
IPS Ceramics LTD UK
Ipsen Ceramics IL
Jyoti Ceramic Industries Pvt Ltd India
KC Abrasive Co KS
KC Industries Pty Ltd Australia
Keir Manufacturing Inc NC
Konoshima Chemical Co Ltd Japan
Kyocera Industrial Ceramics Corp NC
Leico Industries Inc NY
Lithoz GmbH Austria
Maryland Ceramic & Steatite Co Inc MD
Master Bond Inc NJ
McDanel Advanced Ceramic Technologies LLC PA
Metoxit AG Switzerland
MicroCeram Co SC
MicroCIM VT
Microlap Technologies Inc ND
Morgan Advanced Materials CA
Morgan Technical Ceramics Auburn CA
Nanoe France
NEVZ-Ceramics, Close JSC Russia
NGK Spark Plug Co Ltd Japan
Northrop Grumman Corp VA
Nyacol Nano Technologies Inc MA
Ortech Inc CA **See ad page 43**
P-Ker Engineering NY
Precision Ceramics FL
Precision Ferrites & Ceramics Inc CA
PremaTech Advanced Ceramics MA
Progressive Technology Inc CA
Quartzite Processing Inc MA
Rauschert Industries Inc TN
Refractron Technologies Corp NY
Robocasting Enterprises LLC NM
RocCera LLC NY
Saint-Gobain NorPro Corp OH
Sasol North America Inc AZ
Smaht Ceramics Inc UT
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Superior Technical Ceramics Corp VT
TQ Abrasive Machining CA
Tape Casting Consultants Inc PA
Terio Corp China
Tianjin Innova Tech Co Ltd China
Toto Ltd Japan
Valley Design Corp MA
Viridis3D LLC MA
VITO - Flemish Inst for Technological Research Belgium
Xiamen Unipretec Ceramic Technology Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China

Armor, Ceramic
Advanced Ceramics Manufacturing AZ
Advanced Materials Associates CO
Bettini SpA Italy
Cerakote Ceramic Coatings OR
Ceramic Engineering & Consulting Services (CECS) AZ
CeramTec North America Corp SC
CeraNova Corp MA
CerCo LLC OH
ELE Advanced Ceramics China
Enterprise Personnel CO
HC Starck GmbH Germany
Industrial Ceramic Technology MI
Israel Ceramic & Silicate Inst Israel
Metoxit AG Switzerland
Nanomaterials & Nanotechnology Research Center (CINN) Spain

NEVZ-Ceramics, Close JSC Russia
New Tech Ceramics Inc IA
Ortech Inc CA **See ad page 43**
Saint-Gobain Ceramics & Plastics MA
Superior Graphite Co IL **See ad page 55**
Surmet Corp MA
TevTech LLC MA **See ad page 72**

Bearings

Astro Met Advanced Ceramics Inc OH
Bettini SpA Italy
Boca Bearing Co FL
Enterprise Personnel CO
Feldco Intl CA
Ferrotec Ceramic Products China
HC Starck GmbH Germany
Industrial Ceramic Technology MI
Koyo Bearings OH
McDanel Advanced Ceramic Technologies LLC PA
Metoxit AG Switzerland
New Tech Ceramics Inc IA

Ortech Inc CA **See ad page 43**
Precision Ceramics FL
Rauschert Industries Inc TN
Saint-Gobain Ceramic NY **See ad page 53**
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Terio Corp China
Toto Ltd Japan
VITO - Flemish Inst for Technological Research Belgium

Beryllia Products

AdTech Ceramics TN
AK Das, Consultant India
Materion Ceramics AZ
P-Ker Engineering NY
Triangle Ceramics NC

Bioceramics, Dental

Astro Met Advanced Ceramics Inc OH
Bettini SpA Italy
Ceramaret SA Switzerland
Cytophil Inc WI
Ferrotec Ceramic Products China
Fraunhofer-Inst Silicatforschung ISC Germany
HC Starck GmbH Germany
Heany Industries Inc NY
HTI Technologies France
Metoxit AG Switzerland
MicroCIM VT
Mineral Research Processing France
Mo-Sci Corp MO **See ad page 83**
Nanomaterials & Nanotechnology Research Center (CINN) Spain
NovaBone Products LLC FL
Progressive Technology Inc CA
Refractron Technologies Corp NY
Sasol North America Inc AZ
Sem-Com Co Inc OH
Specialty Glass Inc FL
Terio Corp China
Tianjin Innova Tech Co Ltd China
Z-Systems USA Inc MA
Zirox Technologies India

Bioceramics, Medical

ABK Biomedical Inc Canada
AdTech Ceramics TN
Astro Met Advanced Ceramics Inc OH
Ceramaret SA Switzerland
CeramTec North America Corp SC
CoorsTek CO
Cytophil Inc WI
Ferrotec Ceramic Products China
HTI Technologies France
Industrial Ceramic Technology MI
Kyocera Industrial Ceramics Corp NC
Lithoz GmbH Austria
Metoxit AG Switzerland
MicroCIM VT
Mo-Sci Corp MO **See ad page 83**
Momentive Performance Materials Inc NY
Morgan Technical Ceramics Auburn CA
Nanomaterials & Nanotechnology Research Center
NEVZ-Ceramics, Close JSC Russia
nGimat LLC KY
NGK Spark Plug Co Ltd Japan
NovaBone Products LLC FL
Precision Ferrites & Ceramics Inc CA
Refractron Technologies Corp NY
Robocasting Enterprises LLC NM
Sasol North America Inc AZ
Tethon 3D NE
TFD Inc CA
Trans-Tech Inc MD
VITO - Flemish Inst for Technological Research Belgium
Z-Systems USA Inc MA
Zirox Technologies India

Boride Products

Advanced Ceramics Manufacturing AZ
Advanced Materials Associates CO
AK Das, Consultant India
Beijing Cerametek Materials Co Ltd China
Bettini SpA Italy
Dunhua Zhengxing Abrasive Co Ltd China
Momentive Performance Materials Inc NY
Refrac Systems AZ
Saint-Gobain Ceramic NY **See ad page 53**

Carbide Products

Advanced Ceramics Manufacturing AZ
Advanced Materials Associates CO
AK Das, Consultant India
Beijing Cerametek Materials Co Ltd China
Bettini SpA Italy
Ceramic Engineering & Consulting Services (CECS) AZ
COI Ceramics Inc CA
Custom Processing Services PA
Denka Corp NY
Dunhua Zhengxing Abrasive Co Ltd China
Feldco Intl CA
Ferro Ceramic Grinding Inc MA
Ferrotec Ceramic Products China
GW Schultz Tool FL
HC Starck GmbH Germany
Induceramic Canada
Kyocera Industrial Ceramics Corp NC
MicroCIM VT
Momentive Performance Materials Inc NY
Morgan Technical Ceramics Auburn CA
MSE Supplies AZ
NGK Spark Plug Co Ltd Japan
Ortech Inc CA **See ad page 43**
Precision Ceramics FL
Precision Ferrites & Ceramics Inc CA
PremaTech Advanced Ceramics MA
Refrac Systems AZ
Refractory Composites Inc MD
Saint-Gobain Ceramics & Plastics MA
Silicon Carbide Products Inc NY
Superior Graphite Co IL **See ad page 55**
Tenmat Ltd UK
Toto Ltd Japan
Triangle Ceramics NC
VITO - Flemish Inst for Technological Research Belgium
Zhengzhou Mission Ceramic Products Co Ltd China

Catalysts

Arkema Inc PA
Blasch Precision Ceramics Inc NY
fuelcellmaterials.com OH
Haldor Topsoe A/S Denmark
Induceramic Canada
Johnson Matthey Technology Centre UK
MemPro Materials Corp CO
Momentive Performance Materials Inc NY
Nexceris LLC OH
P-Ker Engineering NY
Robocasting Enterprises LLC NM

Alumina Oxide • Zirconia Oxide
Silicon Carbide • Silicon Nitride
Ceramic Bearings

... A few words to mention that we have received the ceramic parts and we want to underline the excellent work done on the manufacturing!

Saint-Gobain NorPro Corp OH
Terio Corp China
Zibo Guangtong Chemical Co Ltd China

Cermets

AdTech Ceramics TN
Advanced Materials Associates CO
Bettini SpA Italy
CeramTec North America Corp SC
Exothermics Inc NH
Innovnano - Advanced Materials SA Portugal
Kyocera Industrial Ceramics Corp NC

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Sauereisen Inc PA **See ad page 47**
Triangle Ceramics NC

Coatings

Advanced Materials Associates CO
AK Das, Consultant India
Aremco Products Inc NY
Arkema Inc PA
Bettini SpA Italy
Bharat Heavy Electricals Ltd India
Cerakote Ceramic Coatings OR
Ceramatec Inc UT
Cetek Ltd OH
Cotronics Corp NY
Exothermics Inc NH
FelCom LLC OR
Flexible Ceramics Inc CA
Fraunhofer-Inst Silicatforschung ISC Germany
Gateway Materials Technology Inc IL
Heany Industries Inc NY
Hexion Inc OH
HTI Technologies France
Jyoti Ceramic Industries Pvt Ltd India
Master Bond Inc NJ
Materion Ceramics AZ
Morgan Advanced Materials CA
Nanofilm OH
National Magnetics Group Inc PA
New Tech Ceramics Inc IA
Nexceris LLC OH
Northrop Grumman Corp VA
P-Ker Engineering NY
Phoenix Coating Resources Inc FL
Refractory Composites Inc MD
Saint-Gobain Ceramic NY **See ad page 53**
Sigma Advanced Materials NY
Technology Assessment & Transfer Inc (TA&T) MD
Teeter Marketing Services LLC FL
Tenmat Ltd UK
Terio Corp China
TevTech LLC MA **See ad page 72**
TFD Inc CA
Trans-Tech Inc MD
Zibo Guangtong Chemical Co Ltd China
ZYP Coatings Inc TN

Composites, Carbon-Carbon

Advanced Materials Associates CO
AK Das, Consultant India
Ceramaterials NY
Ceramic Engineering & Consulting Services (CECS) AZ
COI Ceramics Inc CA
Precision Measurements & Instruments Corp OR
Refrac Systems AZ
Refractory Composites Inc MD
Starfire Systems Inc NY
Tenmat Ltd UK

Composites, Ceramic-Ceramic

Advanced Ceramics Manufacturing AZ
Advanced Composite Materials LLC SC
Advanced Materials Associates CO
Alstom Grid Research & Technology UK
Bharat Heavy Electricals Ltd India
Bullen OH
COI Ceramics Inc CA
Elan Technology GA
FCT Ingenieurkeramik GmbH Germany
Ferro Ceramic Grinding Inc MA
fuelcellmaterials.com OH
Gateway Materials Technology Inc IL
HTI Technologies France
Industrial Ceramic Technology MI
Morgan Technical Ceramics Auburn CA
Nanomaterials & Nanotechnology Research Center (CINN) Spain
NEVZ-Ceramics, Close JSC Russia
New Tech Ceramics Inc IA
Phoenix Coating Resources Inc FL
PremaTech Advanced Ceramics MA
Refrac Systems AZ
Refractory Composites Inc MD
Shandong Diandun Science & Technology Holdings Co Ltd China
Silicon Carbide Products Inc NY
Smaht Ceramics Inc UT
Starfire Systems Inc NY
Technology Assessment & Transfer Inc (TA&T) MD
Tenmat Ltd UK
Trans-Tech Inc MD
Viridis3D LLC MA
Zhengzhou Mission Ceramic Products Co Ltd China
Zircar Ceramics Inc NY

Composites, Ceramic-Metal

AdTech Ceramics TN
Advanced Materials Associates CO
AK Das, Consultant India
COI Ceramics Inc CA
Diamorph AB Sweden
Elan Technology GA
Friatec AG Germany
Innovnano - Advanced Materials SA Portugal
Nanomaterials & Nanotechnology Research Center (CINN) Spain
NEVZ-Ceramics, Close JSC Russia
New Tech Ceramics Inc IA
Precision Ceramics FL
Precision Ferrites & Ceramics Inc CA
Refrac Systems AZ
Refractory Composites Inc MD
SCP Ltd IN
Sigma Advanced Materials NY
Starfire Systems Inc NY
Technology Assessment & Transfer Inc (TA&T) MD
Viridis3D LLC MA
Zibo Guangtong Chemical Co Ltd China

Composites, Ceramic-Polymer

Advanced Materials Associates CO
Bullen OH
Cerakote Ceramic Coatings OR
COI Ceramics Inc CA
NovaBone Products LLC FL
Shandong Diandun Science & Technology Holdings Co Ltd China
Starfire Systems Inc NY
Trans-Tech Inc MD
Verity Technical Consultants LLC OH
Viridis3D LLC MA

Composites, Intermetallic

Feldco Intl CA
VITO - Flemish Inst for Technological Research Belgium
Zibo Guangtong Chemical Co Ltd China

Cutting Tools

Accurate Diamond Tool Corp NJ
Advanced Ceramics Manufacturing AZ
Advanced Materials Associates CO
AK Das, Consultant India
Astro Met Advanced Ceramics Inc OH
Cerakote Ceramic Coatings OR
CeramTec North America Corp SC
Ferro Ceramic Grinding Inc MA
GW Schultz Tool FL
Industrial Ceramic Technology MI
Kyocera Industrial Ceramics Corp NC
Metoxit AG Switzerland
New Tech Ceramics Inc IA
NGK Spark Plug Co Ltd Japan
PremaTech Advanced Ceramics MA
Rauschert Industries Inc TN
RocCera LLC NY
Terio Corp China
Tianjin Innova Tech Co Ltd China
Triangle Ceramics NC
UV Process Supply Inc IL
Xiamen Unipretec Ceramic Technology Co Ltd China
Zibo Guangtong Chemical Co Ltd China

Cylinders

Advanced Ceramics Manufacturing AZ
Bettini SpA Italy
Cerakote Ceramic Coatings OR
ELE Advanced Ceramics China
Ferrotec Ceramic Products China
Morgan Technical Ceramics Auburn CA
Soilmoisture Equipment Corp CA
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Terio Corp China
Triangle Ceramics NC

Dies

Astro Met Advanced Ceramics Inc OH
North Star Equipment Inc WA
Petro Mold Co PA
Ram Products Inc OH
Refractory Specialties Inc OH
Refractron Technologies Corp NY
Xiamen Unipretec Ceramic Technology Co Ltd China
Zircoa Inc OH

Engine Components

Advanced Ceramic Technology CA
Advanced Ceramics Manufacturing AZ
Cerakote Ceramic Coatings OR
Ceramic Engineering & Consulting Services (CECS) AZ
CeramTec North America Corp SC
COI Ceramics Inc CA
ELE Advanced Ceramics China
Federal-Mogul MI
Ferro Ceramic Grinding Inc MA
Ferrotec Ceramic Products China
Gateway Materials Technology Inc IL
GE Global Research NY
HC Starck GmbH Germany
Heany Industries Inc NY
Industrial Ceramic Technology MI
Kyocera Industrial Ceramics Corp NC
Metoxit AG Switzerland
Precision Ceramics FL
PremaTech Advanced Ceramics MA
Terio Corp China
Toyota Central R&D Labs Inc Japan
Xiamen Unipretec Ceramic Technology Co Ltd China
Zirox Technologies India

Filters

Akron Porcelain & Plastics Co OH
Bharat Heavy Electricals Ltd India
Blasch Precision Ceramics Inc NY
Filtros Ltd NY
Induceramic Canada
Kaeser Compressors Inc VA
Liqtech NA Inc MN
Maryland Ceramic & Steatite Co Inc MD
Naylor Hathernware UK
ProChem Inc VA
Rauschert Industries Inc TN
Refractron Technologies Corp NY
Refratarios Paulista Industria e Comercio Ltda Brazil
Robocasting Enterprises LLC NM
Starfire Systems Inc NY
Valley Design Corp MA
VITO - Flemish Inst for Technological Research Belgium
Zhengzhou Mission Ceramic Products Co Ltd China

Glass-Ceramics

Accuratus Corp NJ
AK Das, Consultant India
Alstom Grid Research & Technology UK
Aremco Products Inc NY
Astro Met Advanced Ceramics Inc OH
Bharat Heavy Electricals Ltd India
Cerlase France
Elan Technology GA
Ferro Ceramic Grinding Inc MA
Israel Ceramic & Silicate Inst Israel

Morgan Advanced Materials CA
Ortech Inc CA **See ad page 43**
P-Ker Engineering NY
Petro Mold Co PA
Polymer Innovations Inc CA **See ad page 41**
Precision Ceramics FL
PremaTech Advanced Ceramics MA
Schott North America Inc KY
Sem-Com Co Inc OH
Starfire Systems Inc NY
Technical Products Inc WI
TevTech LLC MA **See ad page 72**
Valley Design Corp MA
Xiamen Unipretec Ceramic Technology Co Ltd China
Zibo Guangtong Chemical Co Ltd China

Heat Exchangers

Arkema Inc PA
Blasch Precision Ceramics Inc NY
COI Ceramics Inc CA
Dowa High Temp Furnaces India
FCT Ingenieurkeramik GmbH Germany
Ferrotec Ceramic Products China
fuelcellmaterials.com OH
Induceramic Canada
Kaeser Compressors Inc VA
Precision Ceramics FL
Refrac Systems AZ
Refractory Composites Inc MD
Saint-Gobain Ceramic NY **See ad page 53**
Technical Ceramics Australia Australia

Honeycombs

Bharat Heavy Electricals Ltd India
Blasch Precision Ceramics Inc NY
Ceramic Oxide Fabricators Pty Ltd Australia
COI Ceramics Inc CA
Induceramic Canada
Koch Knight LLC OH
Rauschert Industries Inc TN
Robocasting Enterprises LLC NM
Smaht Ceramics Inc UT
Zhengzhou Mission Ceramic Products Co Ltd China

Industrial Parts

Accuratus Corp NJ
Advanced Ceramic Technology CA
Advanced Ceramics Manufacturing AZ

Advanced Energy
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Advanced Energy CO **Inside front cover**
Akron Porcelain & Plastics Co OH
Astral Material Industrial Co Ltd China
Astro Met Advanced Ceramics Inc OH
B&B Refractories Inc CA
Bettini SpA Italy
Bharat Heavy Electricals Ltd India
Blasch Precision Ceramics Inc NY
Ceramco Inc NH
Ceramic Engineering & Consulting Services (CECS) AZ
CeramTec North America Corp SC
CerCo LLC OH
COI Ceramics Inc CA
Dowa High Temp Furnaces India
Du-Co Ceramics Co PA
ELE Advanced Ceramics China
Enterprise Personnel CO
ETEC Gesellschaft fuer Technische Keramik GmbH Germany
FCT Ingenieurkeramik GmbH Germany
Ferro Ceramic Grinding Inc MA
Ferrotec Ceramic Products China
Filtros Ltd NY
Friatec AG Germany
Gateway Materials Technology Inc IL
GE Global Research NY
HC Starck GmbH Germany
Heany Industries Inc NY
Induceramic Canada
Industrial Ceramic Products Inc OH
Industrial Ceramic Technology MI
Innalox BV Netherlands
Jyoti Ceramic Industries Pvt Ltd India
KC Industries Pty Ltd Australia
Keir Manufacturing Inc NC
Kyocera Industrial Ceramics Corp NC
McDanel Advanced Ceramic Technologies LLC PA
MicroCeram Co SC
MicroCIM VT
Morgan Advanced Materials CA
Morgan Technical Ceramics Auburn CA
NGK Spark Plug Co Ltd Japan
Northrop Grumman Corp VA
Phoenix Coating Resources Inc FL
Precision Ceramics FL
PremaTech Advanced Ceramics MA
Rauschert Industries Inc TN
Silicon Carbide Products Inc NY
Smaht Ceramics Inc UT
Sonya Ceramics (Export Div) India
Technical Ceramics Australia Australia
Tenmat Ltd UK
Terio Corp China
Tianjin Innova Tech Co Ltd China
Xiamen Unipretec Ceramic Technology Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China

Injection-Molded Ceramics

AdTech Ceramics TN
Bettini SpA Italy
Bharat Heavy Electricals Ltd India
Blasch Precision Ceramics Inc NY
Ceramco Inc NH
Ceramic Engineering & Consulting Services (CECS) AZ
CerCo LLC OH
Diamorph AB Sweden
ELE Advanced Ceramics China
Indo US MIM Tec India
Krautzberger NA LLC VA
Kyocera Industrial Ceramics Corp NC
MicroCIM VT
Ortech Inc CA **See ad page 43**
Rauschert Industries Inc TN
Smaht Ceramics Inc UT
Starfire Systems Inc NY
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Terio Corp China
Xiamen Unipretec Ceramic Technology Co Ltd China

Lasers, Ceramic

Accuratus Corp NJ
Bettini SpA Italy
CeraNova Corp MA
Cerinnov France
Cerlase France
ELE Advanced Ceramics China
Israel Ceramic & Silicate Inst Israel
Morgan Technical Ceramics Auburn CA
nGimat LLC KY
Precision Ceramics FL
Technology Assessment & Transfer Inc (TA&T) MD

Membranes, Ceramic

Bharat Heavy Electricals Ltd India
Ceramatec Inc UT
Cerlase France
fuelcellmaterials.com OH
Hyflux CEPAration Technologies Singapore
Induceramic Canada
Inopor GmbH Germany
NorECs AS Norway
Rauschert Industries Inc TN
Refractron Technologies Corp NY
VITO - Flemish Inst for Technological Research Belgium

Nitride Products

Accuratus Corp NJ
AdTech Ceramics TN
Advanced Ceramic Technology CA
Advanced Ceramics Manufacturing AZ
AK Das, Consultant India
Beijing Cerametek Materials Co Ltd China
Bettini SpA Italy

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Ceramic Engineering & Consulting Services (CECS) AZ
ELE Advanced Ceramics China
FCT Ingenieurkeramik GmbH Germany
Ferro Ceramic Grinding Inc MA
Friatec AG Germany
HC Starck GmbH Germany
Induceramic Canada
Kyocera Corp Japan
Kyocera Industrial Ceramics Corp NC
Maruwa Ceramic Co Ltd Japan
MicroCIM VT
Momentive Performance Materials Inc NY
NEVZ-Ceramics, Close JSC Russia
NGK Spark Plug Co Ltd Japan
Precision Ceramics FL
Precision Ferrites & Ceramics Inc CA
Refractory Composites Inc MD
Saint-Gobain Ceramic NY **See ad page 53**
Saint-Gobain Ceramics & Plastics MA
Silicon Carbide Products Inc NY
Tenmat Ltd UK
Triangle Ceramics NC
VITO - Flemish Inst for Technological Research Belgium
Zhengzhou Mission Ceramic Products Co Ltd China

Nuclear Waste Containers

Precision Ferrites & Ceramics Inc CA
Refractory Composites Inc MD

Optical Ceramics

Ceramic Engineering & Consulting Services (CECS) AZ
CeraNova Corp MA
CiDRA Precision Services LLC CT
ELE Advanced Ceramics China
Feldco Intl CA
Innovnano - Advanced Materials SA Portugal
Kyocera Corp Japan
Morgan Technical Ceramics Auburn CA
MSE Supplies AZ
Nanomaterials & Nanotechnology Research Center (CINN) Spain
nGimat LLC KY
PremaTech Advanced Ceramics MA
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Surmet Corp MA
Technology Assessment & Transfer Inc (TA&T) MD
Tenmat Ltd UK
Terio Corp China
Toto Ltd Japan

Oxide Products

Accuratus Corp NJ
AK Das, Consultant India
Arlimin Industries CO
Associated Ceramics & Technology Inc PA
Astro Met Advanced Ceramics Inc OH
B&B Refractories Inc CA
Beijing Cerametek Materials Co Ltd China
Bettini SpA Italy
Blasch Precision Ceramics Inc NY
Ceramaterials NY
Ceramco Inc NH
Ceramic Engineering & Consulting Services (CECS) AZ
Ceramic Oxide Fabricators Pty Ltd Australia
CeramTec North America Corp SC
COI Ceramics Inc CA
Du-Co Ceramics Co PA
Enterprise Personnel CO
ETEC Gesellschaft fuer Technische Keramik GmbH Germany
Feldco Intl CA
Ferro Ceramic Grinding Inc MA
HC Starck GmbH Germany
HTI Technologies France
Imerys Fused Minerals Murg GmbH Germany
Industrial Ceramic Technology MI
Innalox BV Netherlands
Innovnano - Advanced Materials SA Portugal
Jyoti Ceramic Industries Pvt Ltd India
KC Industries Pty Ltd Australia
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Terio Corp China
TFD Inc CA
Tianjin Innova Tech Co Ltd China
Zircar Ceramics Inc NY
Zirox Technologies India

Porous Ceramics

Associated Ceramics & Technology Inc PA
Bharat Heavy Electricals Ltd India
Ceramco Inc NH
ELE Advanced Ceramics China
Enterprise Personnel CO
Fraunhofer-Inst Silicatforschung ISC Germany
Innalox BV Netherlands
P-Ker Engineering NY
Robocasting Enterprises LLC NM
Smaht Ceramics Inc UT
Soilmoisture Equipment Corp CA
Technology Assessment & Transfer Inc (TA&T) MD
Tethon 3D NE
Zhengzhou Mission Ceramic Products Co Ltd China
Zircar Ceramics Inc NY

Recuperators

Refractory Composites Inc MD

Reinforcements, Fiber

Advanced Composite Materials LLC SC
COI Ceramics Inc CA
ELE Advanced Ceramics China
Fraunhofer-Inst Silicatforschung ISC Germany
MemPro Materials Corp CO
Precision Measurements & Instruments Corp OR

Reinforcements, Whiskers

Advanced Composite Materials LLC SC
Gateway Materials Technology Inc IL
Zircar Ceramics Inc NY

Rings

Astro Met Advanced Ceramics Inc OH
Bettini SpA Italy
Ceramaret SA Switzerland
COI Ceramics Inc CA
CoorsTek CO
Dunhua Zhengxing Abrasive Co Ltd China
ELE Advanced Ceramics China
ETEC Gesellschaft fuer Technische Keramik GmbH Germany
FCT Ingenieurkeramik GmbH Germany
Ferro Ceramic Grinding Inc MA
Ferrotec Ceramic Products China
Heany Industries Inc NY
Industrial Ceramic Products Inc OH
Innalox BV Netherlands
Ipsen Ceramics IL
Kyocera Industrial Ceramics Corp NC
National Magnetics Group Inc PA
Ortech Inc CA **See ad page 43**
Precision Ceramics FL
PremaTech Advanced Ceramics MA
Rauschert Industries Inc TN
Refractron Technologies Corp NY
Saint-Gobain Ceramic NY **See ad page 53**
Saint-Gobain NorPro Corp OH
Silicon Carbide Products Inc NY
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Superior Technical Ceramics Corp VT
TQ Abrasive Machining CA
Tenmat Ltd UK
Tianjin Innova Tech Co Ltd China
VITO - Flemish Inst for Technological Research Belgium
Xiamen Unipretec Ceramic Technology Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China

Rods

Accuratus Corp NJ
Advanced Ceramics Manufacturing AZ
Astro Met Advanced Ceramics Inc OH
Bettini SpA Italy
Ceramaret SA Switzerland
COI Ceramics Inc CA
CoorsTek CO
Du-Co Ceramics Co PA
Dunhua Zhengxing Abrasive Co Ltd China
ELE Advanced Ceramics China
ETEC Gesellschaft fuer Technische Keramik GmbH Germany
FCT Ingenieurkeramik GmbH Germany
Ferro Ceramic Grinding Inc MA
Ferrotec Ceramic Products China
Heany Industries Inc NY
Industrial Ceramic Products Inc OH
Innalox BV Netherlands
Kyocera Industrial Ceramics Corp NC
Morgan Technical Ceramics Auburn CA
National Magnetics Group Inc PA
Ortech Inc CA **See ad page 43**
Precision Ceramics FL
PremaTech Advanced Ceramics MA
Progressive Technology Inc CA
Rauschert Industries Inc TN
Saint-Gobain Ceramic NY **See ad page 53**
Silicon Carbide Products Inc NY
Soilmoisture Equipment Corp CA
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Superior Technical Ceramics Corp VT
Tianjin Innova Tech Co Ltd China
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Xiamen Unipretec Ceramic Technology Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China

Silicide Products

Astral Material Industrial Co Ltd China
Kanthal Heating Systems NY

Silicon Carbide Products

Abresist Corp IN
Accuratus Corp NJ
Advanced Ceramic Technology CA
Advanced Ceramics Manufacturing AZ
Astral Material Industrial Co Ltd China
Bettini SpA Italy
Blasch Precision Ceramics Inc NY
Ceramic Engineering & Consulting Services (CECS) AZ
COI Ceramics Inc CA
Custom Processing Services PA
Diamorph AB Sweden
ELE Advanced Ceramics China
Enterprise Personnel CO
FCT Ingenieurkeramik GmbH Germany
Feldco Intl CA
Ferrotec Ceramic Products China
Friatec AG Germany
HC Starck GmbH Germany
Kanthal Heating Systems NY
Kyocera Corp Japan
Kyocera Industrial Ceramics Corp NC
Liqtech NA Inc MN
Logomatic GmbH Germany
Morgan Advanced Materials CA
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SCP Ltd IN
Silicon Carbide Products Inc NY
Tenmat Ltd UK
TevTech LLC MA **See ad page 72**
Zhengzhou Mission Ceramic Products Co Ltd China

Silicon Nitride Products

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Enterprise Personnel CO
Feldco Intl CA
Ferrotec Ceramic Products China
HC Starck GmbH Germany
Industrial Ceramic Technology MI
Intl Ceramic Engineering MA
Kyocera Corp Japan
Kyocera Industrial Ceramics Corp NC
Maruwa Ceramic Co Ltd Japan
MicroCeram Co SC
Microlap Technologies Inc ND
Morgan Advanced Materials CA
Precision Ceramics FL
Reliance Tool & Manufacturing IL
Saint-Gobain Ceramic NY **See ad page 53**
SCP Ltd IN
Technology Assessment & Transfer Inc (TA&T) MD
Tenmat Ltd UK
Zhengzhou Mission Ceramic Products Co Ltd China

Thread Guides

Akron Porcelain & Plastics Co OH
Associated Ceramics & Technology Inc PA
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Bettini SpA Italy
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CeramTec North America Corp SC
Heany Industries Inc NY
Industrial Ceramic Products Inc OH
Intl Ceramic Engineering MA
Kyocera Industrial Ceramics Corp NC
MicroCIM VT
Rauschert Industries Inc TN
Superior Technical Ceramics Corp VT
Tianjin Innova Tech Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China

Transparent Ceramics

Ceramic Engineering & Consulting Services (CECS) AZ
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ELE Advanced Ceramics China
Enterprise Personnel CO
Ferrotec Ceramic Products China
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Kyocera Industrial Ceramics Corp NC
Nanomaterials & Nanotechnology Research Center (CINN) Spain
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PremaTech Advanced Ceramics MA
Surmet Corp MA
TFD Inc CA

Tubes

Accuratus Corp NJ
AdValue Technology LLC AZ **See ad page 55**
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CeramTec North America Corp SC
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Ferrotec Ceramic Products China
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Friatec AG Germany
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Innalox BV Netherlands
Intl Ceramic Engineering MA
Jyoti Ceramic Industries Pvt Ltd India
Lam Dong Minerals & Building Materials Joint-Stock Co Vietnam
McDanel Advanced Ceramic Technologies LLC PA
Metoxit AG Switzerland
Morgan Technical Ceramics Auburn CA

Ortech Inc CA **See ad page 43**
Precision Ceramics FL
Progressive Technology Inc CA
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Saint-Gobain Ceramic NY **See ad page 53**
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Zircoa Inc OH

Wear-Resistant Parts

Abresist Corp IN
Accuratus Corp NJ
AdValue Technology LLC AZ **See ad page 55**
Advanced Ceramic Technology CA
Advanced Ceramics Manufacturing AZ
Advanced Composite Materials LLC SC
Advanced Superabrasives NV
Akron Porcelain & Plastics Co OH
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Astral Material Industrial Co Ltd China
Astro Met Advanced Ceramics Inc OH
Bettini SpA Italy
Bharat Heavy Electricals Ltd India
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Ceramaret SA Switzerland
Ceramco Inc NH
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Diamorph AB Sweden
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Exothermics Inc NH

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Ferrotec Ceramic Products China
Friatec AG Germany
HC Starck GmbH Germany
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HTI Technologies France
Industrial Ceramic Technology MI
Innalox BV Netherlands
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Kyocera Industrial Ceramics Corp NC
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Metoxit AG Switzerland
MicroCIM VT
Morgan Advanced Materials CA
Morgan Technical Ceramics Auburn CA
NEVZ-Ceramics, Close JSC Russia
New Tech Ceramics Inc IA
NGK Spark Plug Co Ltd Japan
Northrop Grumman Corp VA
Ortech Inc CA **See ad page 43**
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Precision Ceramics FL
PremaTech Advanced Ceramics MA
Progressive Technology Inc CA
Rauschert Industries Inc TN
Refrac Systems AZ
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RocCera LLC NY
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Starfire Systems Inc NY
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Zircoa Inc OH

Zirconia Products

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AdValue Technology LLC AZ **See ad page 55**
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Beijing Cerametek Materials Co Ltd China
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Ceramaret SA Switzerland
Ceramco Inc NH
Ceramic Oxide Fabricators Pty Ltd Australia
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CerCo LLC OH
Chaozhou Three-Circle Co Ltd China
EBL Products Inc CT
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ENrG Inc NY
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Ferrotec Ceramic Products China
Friatec AG Germany
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Imerys Fused Minerals Murg GmbH Germany
Induceramic Canada
Industrial Ceramic Technology MI
Innalox BV Netherlands
Innovnano - Advanced Materials SA Portugal
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Lithoz GmbH Austria
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MSE Supplies AZ
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Nyacol Nano Technologies Inc MA
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Precision Ferrites & Ceramics Inc CA
PremaTech Advanced Ceramics MA
Progressive Technology Inc CA
Rauschert Industries Inc TN
Refractron Technologies Corp NY
Reliance Tool & Manufacturing IL
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RocCera LLC NY
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Tape Casting Consultants Inc PA
Terio Corp China
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Wistra GmbH Germany
Xiamen Unipretec Ceramic Technology Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China
Zibo Guangtong Chemical Co Ltd China
Zircoa Inc OH
Zirox Technologies India

ARTWARE

Ceramic Artware

Arlimin Industries CO
Art On Ceramic Canada
Ceramic Arts Daily OH
Ceramic Knobs & Other Antique Products India
JACPA Ceramic Craftsmen MI
Milestone Decal Art LLC NY
Strico AG Switzerland
StudioLX - Home Decor IL
Tethon 3D NE
Viridis3D LLC MA

Glass Artware

Arlimin Industries CO
Firelight Glass CA
JACPA Ceramic Craftsmen MI
Strico AG Switzerland
StudioLX - Home Decor IL
Viridis3D LLC MA

Lighting

Akron Porcelain & Plastics Co OH
JACPA Ceramic Craftsmen MI
Viridis3D LLC MA

Ornamental Artware

Ceramic Arts Daily OH
JACPA Ceramic Craftsmen MI
Sandkuhl Clay Works Inc OH
StudioLX - Home Decor IL
Viridis3D LLC MA

Pottery

ACCCO Inc/Burley Clay Products Co OH
Arlimin Industries CO
Ceramic Arts Daily OH
Ceramic Knobs & Other Antique Products India
JACPA Ceramic Craftsmen MI
North Star Equipment Inc WA
Peter Pugger Manufacturing Inc CA
Petro Mold Co PA
Ram Products Inc OH
Sheffield Pottery MA
StudioLX - Home Decor IL
Viridis3D LLC MA

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Electro Abrasives Corp NY
Feldco Intl CA
Global Superabrasives AZ
GMA Industries Inc MI
Imerys Refractory Minerals GA
KC Abrasive Co KS
Kyanite Mining Corp VA
Lunzer Technologies Inc NY
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Dynamic Exim Corp India
Momentive Performance Materials Inc NY
Nanoe France
Oglebay Norton Industrial Sands OH
Prince Minerals Inc IL
Sauereisen Inc PA **See ad page 47**

Alumina, Calcined

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Alteo NA LLC OH
AluChem Inc OH
APF Recycling Inc OH
Baikowski Malakoff Inc NC
Denka Corp NY
Dynamic Exim Corp India
Electro Abrasives Corp NY
Friatec AG Germany
Fusion Ceramics Inc OH
Hindalco Industries Ltd India
KC Abrasive Co KS
Luoyang Yilong Refractory Co Ltd China
Maryland Refractories Co OH
Nabaltec AG Germany
Nanoe France
Prince Minerals Inc IL
Refractory Minerals Co Inc PA
Sasol North America Inc AZ
Sauereisen Inc PA **See ad page 47**

Alumina, Fused

Alteo NA LLC OH
China Mineral Processing Ltd China
Denka Corp NY

Dynamic Exim Corp India
Electro Abrasives Corp NY
GMA Industries Inc MI
Imerys Refractory Minerals GA
KC Abrasive Co KS
Lithoz GmbH Austria
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McDanel Advanced Ceramic Technologies LLC PA
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Alumina, Fused Brown

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BassTech Intl NJ
Bosai Minerals Group Co Ltd China
Electro Abrasives Corp NY
GMA Industries Inc MI
Imerys Refractory Minerals GA
KC Abrasive Co KS
Treibacher Schleifmittel North America Inc NY
Washington Mills Electro Minerals Co NY

Alumina, Fused White

Abresist Corp IN
Alteo NA LLC OH
APF Recycling Inc OH
Electro Abrasives Corp NY
Imerys Refractory Minerals GA
KC Abrasive Co KS
Quartzite Processing Inc MA
Sauereisen Inc PA **See ad page 47**
Treibacher Schleifmittel North America Inc NY
Washington Mills Electro Minerals Co NY

Alumina, High-Purity

Alteo NA LLC OH
AluChem Inc OH
APF Recycling Inc OH
Associated Ceramics & Technology Inc PA
Baikowski Malakoff Inc NC
Cerac Inc WI
Ceramaret SA Switzerland
Degussa Corp NJ
Denka Corp NY
Dynamic Exim Corp India
Elan Technology GA
Intl Ceramic Engineering MA
Ipsen Ceramics IL
KC Abrasive Co KS
Lithoz GmbH Austria
Materion Advanced Materials NY
Nanoe France
Pred Materials Intl Inc NY
Prince Minerals Inc IL
Quartzite Processing Inc MA
Rauschert Industries Inc TN
Sasol North America Inc AZ
Sauereisen Inc PA **See ad page 47**
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Valley Design Corp MA
Xiamen Unipretec Ceramic Technology Co Ltd China
Xieta Intl SL Spain
Zirox Technologies India

Alumina, Hydrated

Almatis Inc PA
Alteo NA LLC OH
Denka Corp NY
Dynamic Exim Corp India
Fusion Ceramics Inc OH
Hindalco Industries Ltd India
KC Abrasive Co KS
Kraft Chemical Co IL
Nanoe France
Noah Technologies Corp TX
Prince Minerals Inc IL
RE Carroll Inc PA
Spinks Clay Co TN

Alumina, Other Grades

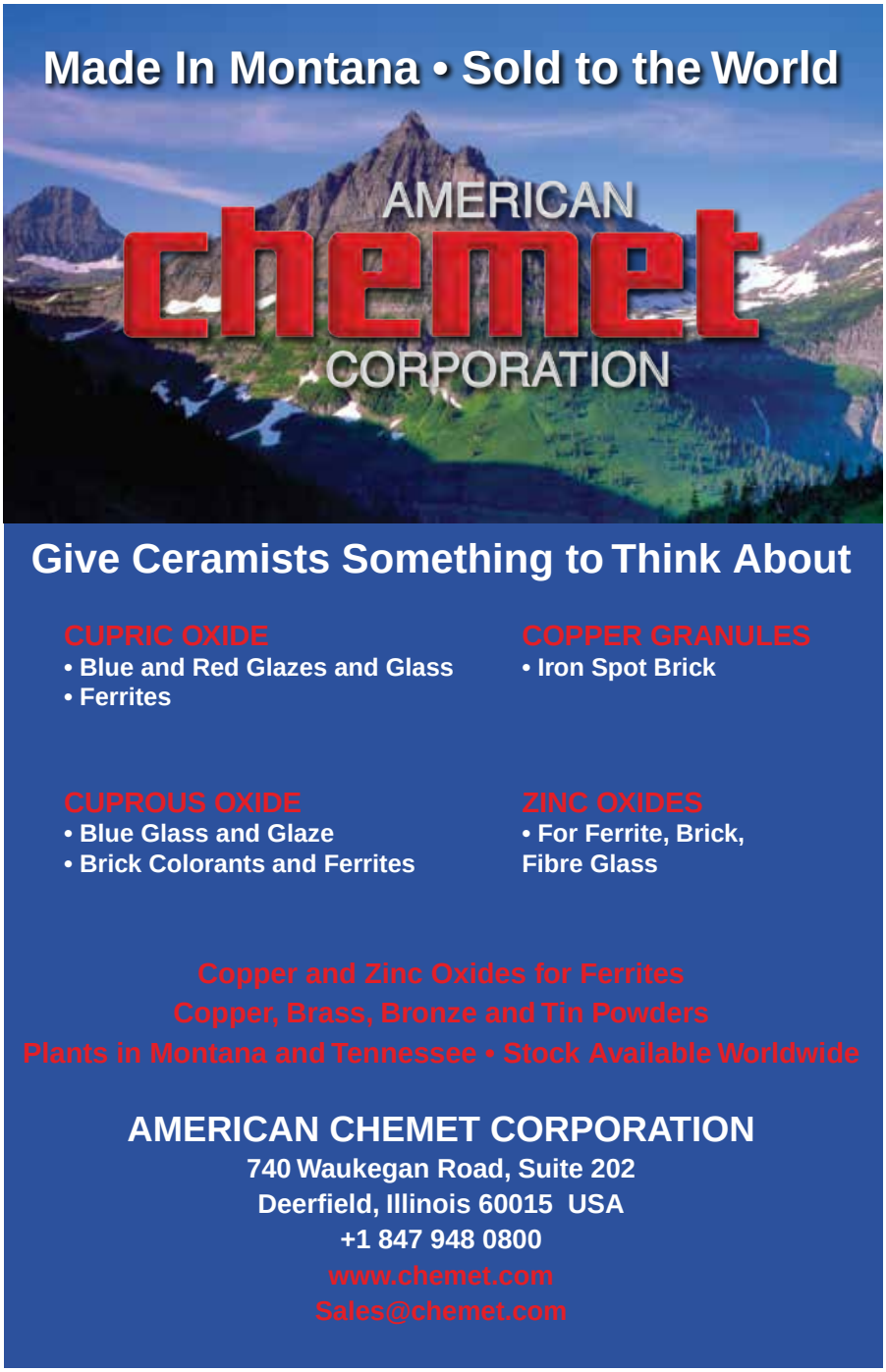
Almatis Inc PA
Alteo NA LLC OH
AluChem Inc OH
Associated Ceramics & Technology Inc PA
Baikowski Malakoff Inc NC
Denka Corp NY
Hindalco Industries Ltd India
Imerys Refractory Minerals GA
KC Abrasive Co KS
Nanoe France
Prince Minerals Inc IL
Sasol North America Inc AZ
Trinity Ceramic Supply Inc TX
Wesbond Corp DE
Xieta Intl SL Spain

Alumina, Reactive

Almatis Inc PA
Alteo NA LLC OH
AluChem Inc OH
Baikowski Malakoff Inc NC
Denka Corp NY
Hindalco Industries Ltd India
Nabaltec AG Germany
Nanoe France
Prince Minerals Inc IL
Zirox Technologies India

Alumina, Single Crystal

Denka Corp NY
Nanoe France
Prince Minerals Inc IL
Superconix Inc MN
Treibacher Schleifmittel North America Inc NY



Alumina, Tabular

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Imerys Refractory Minerals GA
Nanoe France
Prince Minerals Inc IL
Sauereisen Inc PA **See ad page 47**

Alumina, Zirconia Toughened

Associated Ceramics & Technology Inc PA
CerCo LLC OH
Degussa Corp NJ
Denka Corp NY
Friatec AG Germany
Innalox BV Netherlands
Innovnano - Advanced Materials SA Portugal
Nanocerox UT
Nanoe France
Prince Minerals Inc IL
Rauschert Industries Inc TN
Sasol North America Inc AZ
Sauereisen Inc PA **See ad page 47**
Smaht Ceramics Inc UT
Treibacher Schleifmittel North America Inc NY
Washington Mills Electro Minerals Co NY
Xiamen Innovacera Advanced Materials Co China
Zircoa Inc OH
Zirox Technologies India

Aluminum & Compounds

Atlantic Equipment Engineers NJ
BassTech Intl NJ
Denka Corp NY
HC Starck GmbH Germany
Hindalco Industries Ltd India
Innalox BV Netherlands
Leico Industries Inc NY
Refractory Minerals Co Inc PA
Valley Design Corp MA
Xiamen Unipretec Ceramic Technology Co Ltd China

Aluminum Nitride

Atlantic Equipment Engineers NJ
Bullen OH
Centerline Technologies MA
Denka Corp NY
Goodfellow Corp PA
HC Starck North American Trading LLC MA
HC Starck Surface Technology & Ceramic Powders GmbH Germany
Hains Technology Associates Canada
Intl Ceramic Engineering MA
Maruwa Ceramic Co Ltd Japan
Pred Materials Intl Inc NY
Reade Advanced Materials RI
Sasol North America Inc AZ
Surmet Corp MA
Toyal America Inc IL
Triangle Ceramics NC
Valley Design Corp MA

Aluminum Silicate

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Luoyang Yilong Refractory Co Ltd China
Sauereisen Inc PA **See ad page 47**

Antimony & Compounds

Alfa Aesar Johnson Matthey MA

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Arsenic Oxide

Alfa Aesar Johnson Matthey MA
Amalgamet Canada Canada

Barium & Compounds

Alfa Aesar Johnson Matthey MA
American Elements Inc CA **Outside back cover**
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Bosai Minerals Group Co Ltd China
Cerac Inc WI
Dimat Inc WI
Feldco Intl CA
GFS Chemicals Inc OH
Noah Technologies Corp TX
Presto Stantest Pvt Ltd India
Trinity Ceramic Supply Inc TX

Barium Carbonate

BassTech Intl NJ
Fusion Ceramics Inc OH
Hexion Inc OH
Presto Stantest Pvt Ltd India
Process Engineering Services TX
Seaforth Mineral & Ore Co Inc OH

Barium Titanate

AVX Corp SC
BassTech Intl NJ
Beijing Cerametek Materials Co Ltd China
Dimat Inc WI
EDO Corp UT
Euro Support Advanced Materials Netherlands
Haiku Tech Inc FL
Hexion Inc OH
MRA Laboratories Inc MA
nGimat LLC KY
SCI Engineered Materials Inc OH
Superconix Inc MN

Bauxite, Sintered

Alteo NA LLC OH
Luoyang Yilong Refractory Co Ltd China
Presto Stantest Pvt Ltd India

Beryllium & Compounds

APF Recycling Inc OH
Centerline Technologies MA
Leico Industries Inc NY
Materion Advanced Materials NY
Noah Technologies Corp TX
Presto Stantest Pvt Ltd India

Bismuth & Compounds

Atlantic Equipment Engineers NJ
Beijing Cerametek Materials Co Ltd China
Dimat Inc WI
Feldco Intl CA
Fusion Ceramics Inc OH
nGimat LLC KY
SCI Engineered Materials Inc OH

Boric Acid

Amalgamet Canada Canada
Kraft Chemical Co IL
Natl BoraXX Corp OH
Sauereisen Inc PA **See ad page 47**

Boron & Compounds

Amalgamet Canada Canada
Atlantic Equipment Engineers NJ
Beijing Cerametek Materials Co Ltd China
Denka Corp NY
Electro Abrasives Corp NY
Feldco Intl CA
Fusion Ceramics Inc OH
HC Starck North American Trading LLC MA
HC Starck Surface Technology & Ceramic Powders GmbH Germany
Natl BoraXX Corp OH
New Tech Ceramics Inc IA
Noah Technologies Corp TX
Rio Tinto Minerals CO
Seven Stars Intl LLC WA

Boron Carbide

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Boroptik Ltd Sti Turkey
Custom Processing Services PA
Denka Corp NY
Dunhua Zhengxing Abrasive Co Ltd China
Electro Abrasives Corp NY
Feldco Intl CA
Goodfellow Corp PA
HC Starck GmbH Germany
HC Starck North American Trading LLC MA
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Intl Ceramic Engineering MA
Mold Release Products Inc DE
Momentive Performance Materials Inc NY
Precision Ceramics FL
Reade Advanced Materials RI
Saint-Gobain Ceramics & Plastics MA
Xiamen Unipretec Ceramic Technology Co Ltd China

Cadmium & Compounds

Alfa Aesar Johnson Matthey MA
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Calcium & Compounds

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Fusion Ceramics Inc OH
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Unifrax I LLC NY **See ad page 93**

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Trebol USA LLC SC
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Xiamen Unipretec Ceramic Technology Co Ltd China
Z-Tech LLC NH
Zibo Guangtong Chemical Co Ltd China
Zircar Zirconia Inc NY
Zircoa Inc OH
Zirox Technologies India

Zirconia, Engineering-Grade
Friatec AG Germany
Innovnano - Advanced Materials SA Portugal
Leico Industries Inc NY
McDanel Advanced Ceramic Technologies LLC PA
Nanoe France
Trebol USA LLC SC
Z-Tech LLC NH
Zircoa Inc OH
Zirox Technologies India

Zirconia, High-Purity
APF Recycling Inc OH
Degussa Corp NJ
Innovnano - Advanced Materials SA Portugal
Intl Ceramic Engineering MA
Nanocerox UT
Nanoe France
Phoenix Coating Resources Inc FL
Sauereisen Inc PA **See ad page 47**
Tianjin Innova Tech Co Ltd China
Trebol USA LLC SC
Zibo Guangtong Chemical Co Ltd China
Zirox Technologies India

Zirconia, Refractory-Grade
Nanoe France
Phoenix Coating Resources Inc FL
Trebol USA LLC SC
Washington Mills Electro Minerals Co NY
Z-Tech LLC NH
Zircoa Inc OH

Zirconium & Compounds
Atlantic Equipment Engineers NJ
C&L Development Corp CA
Cerac Inc WI
Changsha Langfeng Metallic Material Co Ltd China
Feldco Intl CA
Goodfellow Corp PA
HC Starck GmbH Germany
HC Starck North American Trading LLC MA
HC Starck Surface Technology & Ceramic Powders GmbH Germany
MEL Chemicals UK
Noah Technologies Corp TX
Saint-Gobain Ceramics & Plastics MA
Trebol USA LLC SC
Zibo Guangtong Chemical Co Ltd China

Zirconium Carbide
Changsha Langfeng Metallic Material Co Ltd China
HC Starck Surface Technology & Ceramic Powders GmbH Germany

Zirconium Carbonate
Zibo Guangtong Chemical Co Ltd China

Zirconium Diboride
HC Starck North American Trading LLC MA
HC Starck Surface Technology & Ceramic Powders GmbH Germany
Kraft Chemical Co IL

CLAY & NATURAL MINERALS

Bauxite
APF Recycling Inc OH
Bosai Minerals Group Co Ltd China
China Mineral Processing Ltd China
Dynamic Exim Corp India
Fluid Energy Processing & Equipment Co PA
Hindalco Industries Ltd India
Imerys Refractory Minerals GA
Lock 3 Co PA
Prince Minerals Inc IL

Bentonite
Custom Processing Services PA
Kraft Chemical Co IL
Laviosa Chimica Mineraria SpA Italy
Reade Advanced Materials RI
Spinks Clay Co TN
Stephan Schmidt KG Germany
Trinity Ceramic Supply Inc TX
Vanderbilt Minerals LLC CT

Borax
Amalgamet Canada Canada
Kraft Chemical Co IL
Rio Tinto Minerals CO

Chromite
Comptoir de Mineraux et Matieres Premieres France
Laviosa Chimica Mineraria SpA Italy
Prince Minerals Inc IL

Clays, Ball
Fusion Ceramics Inc OH
Imerys GA
Old Hickory Clay Co KY
Sheffield Pottery MA
Sibelco Benelux Belgium
Spinks Clay Co TN
Stephan Schmidt KG Germany
Trinity Ceramic Supply Inc TX
UMG - United Minerals Group Ukraine
Unimin Corp CT
Vesco JSC Ukraine

Clays, China
China Mineral Processing Ltd China
Fusion Ceramics Inc OH
Imerys GA
Old Hickory Clay Co KY
Sheffield Pottery MA
Sibelco Benelux Belgium
Stephan Schmidt KG Germany
Vanderbilt Minerals LLC CT
Vesco JSC Ukraine

Clays, Enamel
Old Hickory Clay Co KY
Sibelco Benelux Belgium
Stephan Schmidt KG Germany
Vanderbilt Minerals LLC CT
Zirox Technologies India

Clays, Engobe
Imerys GA
Old Hickory Clay Co KY
Sheffield Pottery MA
Sibelco Benelux Belgium
Stephan Schmidt KG Germany
Vanderbilt Minerals LLC CT
Zirox Technologies India

Clays, Fire or Refractory
Alsey Refractories Co MO
Christy Minerals LLC MO
Dynamic Exim Corp India
Furnace Products & Services Inc PA
Imerys Refractory Minerals GA
Lam Dong Minerals & Building Materials Joint-Stock Co Vietnam
Lock 3 Co PA
Maryland Refractories Co OH
Old Hickory Clay Co KY
Peter Pugger Manufacturing Inc CA
Riverside Refractories Inc AL
Sheffield Pottery MA
Sibelco Benelux Belgium
Stephan Schmidt KG Germany
Vesco JSC Ukraine
Whitacre Greer Co OH

Clays, Glaze
Imerys GA
Old Hickory Clay Co KY
Peter Pugger Manufacturing Inc CA
Sheffield Pottery MA
Sibelco Benelux Belgium
Spinks Clay Co TN
Stephan Schmidt KG Germany
Vanderbilt Minerals LLC CT
Vesco JSC Ukraine
Zirox Technologies India

Clays, Stoneware
Christy Minerals LLC MO
Old Hickory Clay Co KY
Peter Pugger Manufacturing Inc CA
Sheffield Pottery MA
Sibelco Benelux Belgium
Stephan Schmidt KG Germany
Vesco JSC Ukraine

Cordierite
Maryland Ceramic & Steatite Co Inc MD
Mason Color Works Inc OH
Reade Advanced Materials RI

Diatomateous Earth
Kraft Chemical Co IL
Reade Advanced Materials RI

Dolomite
Fusion Ceramics Inc OH
Hains Technology Associates Canada
National Lime & Stone Co OH
Sibelco Benelux Belgium
Trinity Ceramic Supply Inc TX

Feldspar
Avalon Rare Metals Inc Canada
Fusion Ceramics Inc OH
Hains Technology Associates Canada
Imerys GA
Kraft Chemical Co IL
Pacer Co SD
Prince Minerals Inc IL
Sheffield Pottery MA
Sibelco Benelux Belgium
Trinity Ceramic Supply Inc TX
Zirox Technologies India

Flint
China Mineral Processing Ltd China
Christy Minerals LLC MO
Oglebay Norton Industrial Sands OH
Sheffield Pottery MA
Short Mountain Silica TN

Fluorspar
Hains Technology Associates Canada
Seaforth Mineral & Ore Co Inc OH

Forsterite
Du-Co Ceramics Co PA

Kaolin
Arkema Inc PA
Bosai Minerals Group Co Ltd China
China Mineral Processing Ltd China
Christy Minerals LLC MO
Fusion Ceramics Inc OH
Imerys GA
Imerys Refractory Minerals GA
Lam Dong Minerals & Building Materials Joint-Stock Co Vietnam
M&M Clays Inc GA
Old Hickory Clay Co KY
RE Carroll Inc PA
Reade Advanced Materials RI
Sheffield Pottery MA
Spinks Clay Co TN
Stephan Schmidt KG Germany
Trinity Ceramic Supply Inc TX
US Silica Co MD
Vanderbilt Minerals LLC CT
Zirox Technologies India

Kyanite
Kyanite Mining Corp VA
Lock 3 Co PA
Pryor Giggey Co AL

Lime & Limestone
Dynamic Exim Corp India
Hains Technology Associates Canada
Kraft Chemical Co IL
National Lime & Stone Co OH
Prince Minerals Inc IL
RE Carroll Inc PA
Spinks Clay Co TN

Lithium Minerals
Amalgamet Canada Canada
Avalon Rare Metals Inc Canada

Fusion Ceramics Inc OH
Hains Technology Associates Canada

Magnesite
APF Recycling Inc OH
Bosai Minerals Group Co Ltd China
Fluid Energy Processing & Equipment Co PA
Imerys Refractory Minerals GA
Lock 3 Co PA

Mica
Amalgamet Canada Canada
Comptoir de Mineraux et Matieres Premieres France
Imerys GA
Kraft Chemical Co IL
Pacer Co SD

Montmorillonite
Reade Advanced Materials RI
Vanderbilt Minerals LLC CT

Mullite
China Mineral Processing Ltd China
Christy Minerals LLC MO
Imerys Refractory Minerals GA
Intl Ceramic Engineering MA
Kyanite Mining Corp VA
Pred Materials Intl Inc NY
Reade Advanced Materials RI
Texers Technical Ceramics Inc Canada
Washington Mills Electro Minerals Co NY

Nepheline Syenite
Fusion Ceramics Inc OH
Hains Technology Associates Canada
Sheffield Pottery MA
Sibelco Benelux Belgium
Trinity Ceramic Supply Inc TX

Olivine
Lock 3 Co PA
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Pyrite
Kyanite Mining Corp VA

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Quartz
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Dynasil Fused Silica NJ
Fusion Ceramics Inc OH
Goodfellow Corp PA
Hains Technology Associates Canada
Imerys GA
Intl Ceramic Engineering MA
Momentive Performance Materials Inc NY
Oglebay Norton Industrial Sands OH
Prince Minerals Inc IL
Quartzite Processing Inc MA
Short Mountain Silica TN
Sibelco Benelux Belgium

Rutile
Cristal Inc MD
Fusion Ceramics Inc OH
Hains Technology Associates Canada
Kraft Chemical Co IL
Prince Minerals Inc IL

Sapphire
Centerline Technologies MA
Goodfellow Corp PA
Intl Ceramic Engineering MA
Logomatic GmbH Germany
Quartzite Processing Inc MA
Sasol North America Inc AZ

Silica
APF Recycling Inc OH
Centerline Technologies MA
Hains Technology Associates Canada
Imerys GA
Imerys Refractory Minerals GA
Lock 3 Co PA
Maryland Refractories Co OH
Oglebay Norton Industrial Sands OH
Prince Minerals Inc IL
Short Mountain Silica TN
Sibelco Benelux Belgium
Trinity Ceramic Supply Inc TX
US Silica Co MD

Soda Ash
Fusion Ceramics Inc OH
Kraft Chemical Co IL
RE Carroll Inc PA

Spinels
Almatis Inc PA
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Steatite
Du-Co Ceramics Co PA
Intl Ceramic Engineering MA
Maryland Ceramic & Steatite Co Inc MD

Talc
Custom Processing Services PA
Fusion Ceramics Inc OH
Hains Technology Associates Canada
Rio Tinto Minerals CO
Spinks Clay Co TN
Trinity Ceramic Supply Inc TX

Vermiculite
Comptoir de Mineraux et Matieres Premieres France
Hains Technology Associates Canada

Wollastonite
Bosai Minerals Group Co Ltd China
Eppler Associates CT
Fusion Ceramics Inc OH
Hains Technology Associates Canada
NYCO Minerals Inc NY
Reade Advanced Materials RI
Seaforth Mineral & Ore Co Inc OH
Trinity Ceramic Supply Inc TX
Vanderbilt Minerals LLC CT

Zircon
AluChem Inc OH
APF Recycling Inc OH
Comptoir de Mineraux et Matieres Premieres France
Fusion Ceramics Inc OH
Lithoz GmbH Austria
Lock 3 Co PA
Prince Minerals Inc IL
Reade Advanced Materials RI
TAM Ceramics NY
Trebol USA LLC SC

CONSTRUCTION CERAMICS

Brick
Belden Brick Co OH
Brick Industry Assn VA
Khodiyar Ceramics (India) Pvt Ltd India
Niokem Inc NC
Zibo Guangtong Chemical Co Ltd China

Brick & Paving
Belden Brick Co OH
Brick Industry Assn VA
Khodiyar Ceramics (India) Pvt Ltd India
Koch Knight LLC OH
Naylor Hathernware UK
Niokem Inc NC
Whitacre Greer Co OH

Flue Liners
Abresist Corp IN
Sandkuhl Clay Works Inc OH

Pipe, Ceramic-Lined
Abresist Corp IN
CerCo LLC OH
Tenmat Ltd UK

Sanitaryware
Roca Sanitario SA Spain
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Heartl& Wood Flooring FL
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Naylor Hathernware UK
Somany Ceramics Ltd India
Tethon 3D NE

Tile, Wall
Comtrust Architectural Mesh Co Ltd China
London Tile Co OH
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Somany Ceramics Ltd India
Tethon 3D NE

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Cerakote Ceramic Coatings OR
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Gateway Materials Technology Inc IL
Gwent Electronic Materials Ltd UK
Hains Technology Associates Canada
Industrial Testing Laboratories Inc MO
Innovative Research & Products Inc CT
Integrity Testing Laboratory Inc Canada
Microplasmic Corp MA
National Magnetics Group Inc PA
New Tech Ceramics Inc IA
Smaht Ceramics Inc UT
Technology Assessment & Transfer Inc (TA&T) MD
Teeter Marketing Services LLC FL
TFD Inc CA
Trans-Tech Inc MD
Viridis3D LLC MA

Analytical Services
Activation Laboratories Ltd Canada
Alfred University NY
ATS RheoSystems, A Div of Cannon Instrument Co PA
AVEKA MN
CelSian Glass & Solar BV Netherlands
Chemir - A Div of Evans Analytical Group MO
CMC Laboratories Inc AZ
Edward Orton Jr Ceramic Foundation OH
FelCom LLC OR
Gateway Materials Technology Inc IL

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SGS Minerals Services Canada

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Chemical Analysis
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Spectrochemical Laboratories PA
TA Instruments DE **See ad page 99**

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Innovative Processing Solutions LLC IN
Khodiyar Ceramics (India) Pvt Ltd India
Lucideon UK
Niokem Inc NC
OPF Enterprises MT
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Process Engineering Services TX
Verity Technical Consultants LLC OH

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H&M Analytical Services Inc NJ
Hains Technology Associates Canada
Hitech Materials Pty Ltd Australia
Imerys GA
Industrial Ceramic Technology MI
Industrial Testing Laboratories Inc MO
Innalox BV Netherlands
Innovative Research & Products Inc CT
Inst for Applied Materials-Ceramics in Mechanical Engineering, Karlsruhe Inst of Technology Germany
Intl Ceramic Engineering MA
Lithoz GmbH Austria
Lucideon UK
MemPro Materials Corp CO
MRA Laboratories Inc MA
Nanomaterials & Nanotechnology Research Center (CINN) Spain
National Magnetics Group Inc PA
Naylor Hathernware UK
Northrop Grumman Corp VA
NSL Analytical Services Inc OH
OPF Enterprises MT
P-Ker Engineering NY
Process Engineering Services TX
Rauschert Industries Inc TN
Refrac Systems AZ
Rensselaer Polytechnic Inst NY
Silicon Carbide Products Inc NY
Smaht Ceramics Inc UT
Structural Ceramic Solutions NY
Tape Casting Consultants Inc PA
Tape Casting Warehouse Div PA
Technology Assessment & Transfer Inc (TA&T) MD
Teeter Marketing Services LLC FL
Texers Technical Ceramics Inc Canada
Verity Technical Consultants LLC OH
Viridis3D LLC MA

Chemistry

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Chemical Abstracts Service OH
Chemir - A Div of Evans Analytical Group MO
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fuelcellmaterials.com OH
H&M Analytical Services Inc NJ
Hitech Materials Pty Ltd Australia
Industrial Testing Laboratories Inc MO
NSL Analytical Services Inc OH
SGS Minerals Services Canada

Combustion Systems

Air Products & Chemicals Inc PA
CelSian Glass & Solar BV Netherlands
Ceramic Services Inc PA
Ciria India Ltd India
Elster-Hauck Manufacturing Co PA

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Harrop Industries Inc OH **See ad page 67**
Micropyretics Heaters Intl Inc OH

Compositions

AbNat Ltd NV
Activation Laboratories Ltd Canada
Advanced Materials Associates CO
Alstom Grid Research & Technology UK
ATC Consulting Services CA
CelSian Glass & Solar BV Netherlands
Chemir - A Div of Evans Analytical Group MO
Eppler Associates CT
fuelcellmaterials.com OH
Gwent Electronic Materials Ltd UK
Hitech Materials Pty Ltd Australia
Industrial Testing Laboratories Inc MO
Innovative Research & Products Inc CT
NSL Analytical Services Inc OH
Sem-Com Co Inc OH
Specialty Glass Inc FL
Tape Casting Consultants Inc PA
Trans-Tech Inc MD

Decorating Processes & Materials

Cerlase France
Eppler Associates CT
Industrial Testing Laboratories Inc MO
JACPA Ceramic Craftsmen MI
Lucideon UK
OPF Enterprises MT
Print Control Services LLC MA
Strico AG Switzerland

Design

Air Force Civil Engineer Center FL
Alstom Grid Research & Technology UK
ATC Consulting Services CA
Eglasstrek Patent Promotion & Awarding GmbH Germany
General Glass Equipment Co NJ
I Squared R Element Co NY **See ad page 71**
Jenike & Johanson Inc MA
Missouri Refractories Co (MORCO) MO
OPF Enterprises MT
RocCera LLC NY
Structural Ceramic Solutions NY
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AVEKA MN
Centerline Technologies MA
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Gwent Electronic Materials Ltd UK
Haiku Tech Europe BV Netherlands
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I Squared R Element Co NY **See ad page 71**

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MRA Laboratories Inc MA
Powder Processing & Technology LLC IN
Semiconductor Energy Laboratory Co Ltd Japan
Superconix Inc MN
Trans-Tech Inc MD

Energy

A123 Systems Inc MA
Advanced Energy CO **Inside front cover**
Air Force Civil Engineer Center FL
CelSian Glass & Solar BV Netherlands
Ceralink Inc NY
Ciria India Ltd India
EWI OH
FCT Systeme GmbH Germany
Gateway Materials Technology Inc IL
Innovative Research & Products Inc CT
Integrity Testing Laboratory Inc Canada
Lucideon UK
Micropyretics Heaters Intl Inc OH
Polymer Innovations Inc CA **See ad page 41**
Semiconductor Energy Laboratory Co Ltd Japan
Solidia Technologies Inc NJ
Structural Ceramic Solutions NY
Texers Technical Ceramics Inc Canada

Engineering

Advanced Materials Associates CO
Air Force Civil Engineer Center FL
Alstom Grid Research & Technology UK
ATC Consulting Services CA
CelSian Glass & Solar BV Netherlands
CERIC Technologies France
Cerinnov France
Ceritherm France
Ciria India Ltd India
Cyclonaire Corp NE
Eglasstrek Patent Promotion & Awarding GmbH Germany
EWI OH
FCT Systeme GmbH Germany
General Glass Equipment Co NJ
Hitech Materials Pty Ltd Australia
Innalox BV Netherlands
Innovative Processing Solutions LLC IN
Intl Ceramic Engineering MA
Jenike & Johanson Inc MA
Lithoz GmbH Austria
Microplasmic Corp MA
Nol-Tec Systems Inc MN
Physical Acoustics Corp NJ
Specialty Glass Inc FL
Structural Ceramic Solutions NY
Teeter Marketing Services LLC FL
Verity Technical Consultants LLC OH
Wistra France
Wistra GmbH Germany

Environmental

Activation Laboratories Ltd Canada
Air Force Civil Engineer Center FL
Alstom Grid Research & Technology UK
ATC Consulting Services CA
CelSian Glass & Solar BV Netherlands
Eppler Associates CT
Industrial Testing Laboratories Inc MO
Lucideon UK
SEMTech Solutions Inc MA
Solidia Technologies Inc NJ
Texers Technical Ceramics Inc Canada
Tri-Mer Corp MI

Expert Witness

Advanced Materials Associates CO
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Chemir - A Div of Evans Analytical Group MO
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EWI OH
Gateway Materials Technology Inc IL
H&M Analytical Services Inc NJ
Hitech Materials Pty Ltd Australia
Industrial Testing Laboratories Inc MO
Innovative Research & Products Inc CT
Integrity Testing Laboratory Inc Canada
JTF Microscopy Services Inc NY
Lucideon UK
Particle Technology Labs IL
Peter Schultz Consulting LLC CT
Refrac Systems AZ
Refractory Consulting Services OH
Spontaneous Materials CO
Structural Ceramic Solutions NY
Verity Technical Consultants LLC OH

Fabrication

Able Supply Co TX
Accuratus Corp NJ
Advanced Materials Associates CO
Angstrom Precision Optics Inc NY
ATC Consulting Services CA
Bullen OH
Ceramic Engineering & Consulting Services (CECS) AZ
EWI OH
Gateway Materials Technology Inc IL
Huber Construction Inc TX
Innalox BV Netherlands
Lithoz GmbH Austria
MicroCIM VT
PremaTech Advanced Ceramics MA
Quartzite Processing Inc MA
Refrac Systems AZ
RocCera LLC NY
Tape Casting Consultants Inc PA
Technology Assessment & Transfer Inc (TA&T) MD
Thermal Products Co Inc GA
Verity Technical Consultants LLC OH

Furnaces

Able Supply Co TX
Advanced Materials Associates CO
American Isostatic Presses OH
ATC Consulting Services CA
Birney W West PE TX
Casso-Solar Technologies NY
CelSian Glass & Solar BV Netherlands
Centorr Vacuum Industries NH
Ceramic Engineering & Consulting Services (CECS) AZ
Cetek Ltd OH
Ciria India Ltd India
Fosbel Inc OH
General Glass Equipment Co NJ
Harper Intl NY
Huber Construction Inc TX
R Element Co NY **See ad page 71**
JTF Microscopy Services Inc NY
Micropyretics Heaters Intl Inc OH
OPF Enterprises MT
Refrac Systems AZ
Technology Assessment & Transfer Inc (TA&T) MD
The Furnace Source LLC CT
Trent Inc PA
Winner Technology South Korea **See ad page 73**

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ATC Consulting Services CA
Ceradyne Inc, a 3M Co WA **See ad page 51**
Eppler Associates CT
GV Service Inc NY
Industrial Testing Laboratories Inc MO
Laguna Clay Co CA
Lucideon UK
NSL Analytical Services Inc OH
OPF Enterprises MT
Process Engineering Services TX

High-Technology Ceramics

Advanced Materials Associates CO
AK Das, Consultant India
Alstom Grid Research & Technology UK
APC Intl Ltd PA
ARBURG GmbH & Co KG Germany
Astro Met Advanced Ceramics Inc OH
ATC Consulting Services CA
Bharat Heavy Electricals Ltd India
Ceramic Engineering & Consulting Services (CECS) AZ
Ceramitec NY
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EWI OH
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Innalox BV Netherlands
Innovative Research & Products Inc CT
Lucideon UK
Microplasmic Corp MA
Nanomaterials & Nanotechnology Research Center (CINN) Spain
NSL Analytical Services Inc OH
OPF Enterprises MT
P-Ker Engineering NY
Quartzite Processing Inc MA
Silicon Carbide Products Inc NY
Smaht Ceramics Inc UT
Tape Casting Consultants Inc PA
Technology Assessment & Transfer Inc (TA&T) MD
Trans-Tech Inc MD
Viridis3D LLC MA
Wistra France
Wistra GmbH Germany
Zircoa Inc OH

Kilns

Birney W West PE TX
CERIC Technologies France
Ceritherm France
FCT Systeme GmbH Germany
Lucideon UK
Nabertherm Inc DE
OPF Enterprises MT

Litigation

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H&M Analytical Services Inc NJ
Integrity Testing Laboratory Inc Canada
Lucideon UK
Particle Technology Labs IL

Process Engineering Services TX
Refractory Consulting Services OH
Spontaneous Materials CO
Verity Technical Consultants LLC OH

Maintenance & Repairs, After Sales
AK Das, Consultant India
Cerinnov France
Cetek Ltd OH
Ciria India Ltd India
GV Service Inc NY
ROmiLL sro Czech Republic

Management
AK Das, Consultant India
ATC Consulting Services CA
Gateway Materials Technology Inc IL
Hains Technology Associates Canada
Management Recruiters of Aiken SC SC
OPF Enterprises MT
Print Control Services LLC MA
Structural Ceramic Solutions NY
Teeter Marketing Services LLC FL

Manufacturing
Advanced Materials Associates CO
AK Das, Consultant India
Angstrom Precision Optics Inc NY
ATC Consulting Services CA
AVEKA MN
Ceramco Inc NH
Ceramic Engineering & Consulting Services (CECS) AZ
CeramTec North America Corp SC
Cerinnov France
Custom Processing Services PA
Cyclonaire Corp NE
EWI OH
Gateway Materials Technology Inc IL
GV Service Inc NY
Hains Technology Associates Canada
Ikonics Imaging-Industrial Solutions MN
Innovative Processing Solutions LLC IN
JACPA Ceramic Craftsmen MI
Jenike & Johanson Inc MA
Krautzberger NA LLC VA
Laserage Technology Corp IL
Lucideon UK
Maryland Ceramic & Steatite Co Inc MD
MicroCIM VT
Micropyretics Heaters Intl Inc OH
OPF Enterprises MT
P-Ker Engineering NY
Print Control Services LLC MA
Quartzite Processing Inc MA
Refrac Systems AZ
Reliance Tool & Manufacturing IL
Semiconductor Energy Laboratory Co Ltd Japan
Smaht Ceramics Inc UT
Structural Ceramic Solutions NY
Tape Casting Consultants Inc PA
Technology Assessment & Transfer Inc (TA&T) MD
Verity Technical Consultants LLC OH
Wistra France
Wistra GmbH Germany

Markets
Advanced Materials Associates CO
AK Das, Consultant India
ATC Consulting Services CA
fuelcellmaterials.com OH
Gateway Materials Technology Inc IL
Hains Technology Associates Canada
Innovative Research & Products Inc CT
OPF Enterprises MT
Structural Ceramic Solutions NY
Tape Casting Consultants Inc PA
Teeter Marketing Services LLC FL
Texers Technical Ceramics Inc Canada

Materials Testing & Characterization
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Alstom Grid Research & Technology UK
Angstrom Precision Optics Inc NY
ARBURG GmbH & Co KG Germany
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ATS RheoSystems, A Div of Cannon Instrument Co PA
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Oneida Research Services Inc NY
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Smaht Ceramics Inc UT
Starfire Systems Inc NY
Superior Technical Ceramics Corp VT
TQ Abrasive Machining CA
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Cerakote Ceramic Coatings OR
Cetek Ltd OH
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ESL ElectroScience PA
EWI OH
FelCom LLC OR
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Refractory Composites Inc MD
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Renite Co OH
Starfire Systems Inc NY
Technology Assessment & Transfer Inc (TA&T) MD
TevTech LLC MA **See ad page 72**
Trans-Tech Inc MD
Verity Technical Consultants LLC OH

Coatings, Thermal-Resistant
Aremco Products Inc NY
Beamalloy Technologies LLC OH
Cerakote Ceramic Coatings OR
Cetek Ltd OH
Clarkson University NY
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ESL ElectroScience PA
EWI OH

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Sigma Advanced Materials NY
Smaht Ceramics Inc UT
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Coatings, Wear-Resistant

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TevTech LLC MA **See ad page 72**
Trans-Tech Inc MD

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Beamalloy Technologies LLC OH
DuPont Electronic Technologies NC
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Haiku Tech Inc FL
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MRA Laboratories Inc MA
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Quartzite Processing Inc MA
Sigma Advanced Materials NY
Starfire Systems Inc NY
Tape Casting Consultants Inc PA
TFD Inc CA
Trans-Tech Inc MD

Drying, Custom

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Reade Advanced Materials RI

Films, Thick

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ESL ElectroScience PA
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Gwent Electronic Materials Ltd UK
Intelligent Micro Patterning LLC FL
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P-Ker Engineering NY
Polymer Innovations Inc CA **See ad page 41**
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Films, Thin

Advanced Energy CO **Inside front cover**
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Teeter Marketing Services LLC FL
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Cetek Ltd OH
Fosbel Inc OH

Joining

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Cetek Ltd OH
EWI OH
Fosbel Inc OH
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Fuse Tech/Hot Tech Group OH
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Fosbel Inc OH
KC Industries Pty Ltd Australia
Koch Knight LLC OH
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Riverside Refractories Inc AL
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Fusion Ceramics Inc OH
Mason Color Works Inc OH

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Sem-Com Co Inc OH
Thompson Enamel Inc KY
Trinity Ceramic Supply Inc TX

Glazes
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Ceramic Color & Chemical Manufacturing Co PA
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Eppler Associates CT
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Futura Ceramics Pvt Ltd India
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Maruwa Ceramic Co Ltd Japan
Mason Color Works Inc OH
Sem-Com Co Inc OH
Sheffield Pottery MA

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Intelligent Micro Patterning LLC FL
Novadis GmbH Switzerland
Videojet Technologies Inc IL
Zibo Guangtong Chemical Co Ltd China

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Recco Furnaces CA

Lusters
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Pad Printing Dies
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Thompson Enamel Inc KY

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Silver Pastes, Conducting
DuPont Electronic Technologies NC
Master Bond Inc NJ

Spray Booths
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Laguna Clay Co CA

Stains
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Fusion Ceramics Inc OH
Mason Color Works Inc OH
Sheffield Pottery MA
Trinity Ceramic Supply Inc TX

DINNERWARE

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Cerinnov France
Krautzberger NA LLC VA
Shenzhen Top Best Ceramics Co Ltd China
StudioLX - Home Decor IL

China, Food Service
JACPA Ceramic Craftsmen MI
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Tethon 3D NE

Cookware
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Earthenware
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Harrop Industries Inc OH **See ad page 67**
Keith Co CA
Nutec Bickley Mexico
Recco Furnaces CA
Swindell Dressler Intl Co PA
Takasago Industry Co Ltd Japan
Wistra France
Wistra GmbH Germany

Lehrs
Casso-Solar Technologies NY
Ceramic Services Inc PA
Harrop Industries Inc OH **See ad page 67**
Keith Co CA
Recco Furnaces CA

Microwave Systems
Bharat Heavy Electricals Ltd India
Ceralink Inc NY
Ceritherm France
CM Furnaces Inc NJ
Cober Muegge LLC CT
Drayton Beaumont Kilns Ltd UK
Gerling Applied Engineering Inc CA

HARROP INDUSTRIES, INC.
3470 East Fifth Ave., Columbus, Ohio, USA
PH: (614) 231-3621
www.harropusa.com

Harrop Industries Inc OH **See ad page 67**
Linn High Therm GmbH Germany
PSC Inc OH
RocCera LLC NY
ROmiLL sro Czech Republic
Takasago Industry Co Ltd Japan

Oxygen Supply
Air Products & Chemicals Inc PA

Process/Quality Control Systems
Applied Test Systems Inc PA
BDF Industries Italy
Datapaq Inc NH
General Glass Equipment Co NJ
Materials Research Furnaces Inc NH **See ad page 74**
Micropyretics Heaters Intl Inc OH
Stelter & Brinck Ltd OH

Pyrometric Cones/Plaques
American Art Clay Co Inc IN
Edward Orton Jr Ceramic Foundation OH
Industrial Ceramic Products Inc OH
PSH Kilns & Furnaces Canada
Trinity Ceramic Supply Inc TX

Sensors, Temperature

Advanced Energy
TECHNOLOGIES FOR THERMAL PROCESSING
advanced-energy.com/acs

Advanced Energy CO **Inside front cover**
Datapaq Inc NH
UV Process Supply Inc IL
Zibo Guangtong Chemical Co Ltd China

Thermocouples & Accessories
AdValue Technology LLC AZ **See ad page 55**
American Art Clay Co Inc IN
American Isostatic Presses OH
CM Furnaces Inc NJ
Datapaq Inc NH
Drayton Beaumont Kilns Ltd UK
Gasbarre Products (PTX Pentronix) PA **See ad page 81**
Harrop Industries Inc OH **See ad page 67**
Keith Co CA
Krumor Inc OH
Leico Industries Inc NY
Materials Research Furnaces Inc NH **See ad page 74**
McDanel Advanced Ceramic Technologies LLC PA
Prairie Ceramics Corp CA
PSH Kilns & Furnaces Canada
Quintus Technologies LLC OH
Recco Furnaces CA

EDUCATION & RESOURCES

Associations & Societies
Assn of American Ceramic Component Manufacturers (AACCM) OH
Brick Industry Assn VA
Ceramic Education Council OH
Glass Manufacturing Industry Council OH
Indian Ceramic Society India
Intl Centre for Diffraction Data PA
Journal of the American Ceramic Society OH
National Inst of Ceramic Engineers OH
New Glass Forum Japan
Portland Cement Assn IL
SAMPE CA
Society of Glass & Ceramic Decorated Products (SGCD) OH
The American Ceramic Society OH
Tile Heritage Foundation CA

Books
APC Intl Ltd PA
Bharat Heavy Electricals Ltd India
Eppler Associates CT
Glass Factory Directory of North America NY
Journal of the American Ceramic Society OH
Micromechatronics Inc PA
Portland Cement Assn IL
SAMPE CA
Sheffield Pottery MA
Tile Heritage Foundation CA

Continuing Education
Alfred University NY
Arizona State University AZ
CelSian Glass & Solar BV Netherlands
Cornell University NY
Eppler Associates CT
Florida Inst of Technology Continuing Education FL
Fraunhofer Inst for Ceramic Technologies & Systems IKTS Germany
Intl Centre for Diffraction Data PA
Jenike & Johanson Inc MA
JTF Microscopy Services Inc NY
New Glass Forum Japan
Physical Acoustics Corp NJ
Portland Cement Assn IL
Spontaneous Materials CO
Strainoptics Inc PA
Tethon 3D NE

Degree Programs, ABET Accredited
Alfred University NY
Case Western Reserve University OH
Cornell University NY
Massachusetts Inst of Technology MA
Missouri University of Science & Technology MO
National Inst of Ceramic Engineers OH
Rensselaer Polytechnic Inst NY

Degree Programs, Ceramic
Alfred University NY
Fraunhofer Inst for Ceramic Technologies & Systems IKTS Germany
Massachusetts Inst of Technology MA
Missouri University of Science & Technology MO

Degree Programs, Glass Engrg Science
Alfred University NY
Fraunhofer Inst for Ceramic Technologies & Systems IKTS Germany

Degree Programs, Materials Science
Alfred University NY
Arizona State University AZ
Case Western Reserve University OH
Clarkson University NY
Cornell University NY
Fraunhofer Inst for Ceramic Technologies & Systems IKTS Germany
Massachusetts Inst of Technology MA
Missouri University of Science & Technology MO
Rensselaer Polytechnic Inst NY

Employment Services
Ceramic Recruiters Inc SC
Enterprise Personnel CO
SAMPE CA

Publications
American Ceramic Society Bulletin OH
American Scientific Publishers CA
Ceramic Industry Magazine MI
Chemical Abstracts Service OH
Glass Factory Directory of North America NY
Indian Ceramic Society India
Journal of the American Ceramic Society OH
Prolec SA de CV Mexico
Society of Glass & Ceramic Decorated Products (SGCD) OH
Tile Heritage Foundation CA

■ ELECTRICAL/ELECTRONIC CERAMICS

Antennas, Dielectric
Euro Support Advanced Materials Netherlands
Friatec AG Germany
Olevsk Porcelain Plant Ukraine

Capacitors
Advanced Materials Technologies PA
Associated Ceramics & Technology Inc PA
AVX Corp SC
Chaozhou Three-Circle Co Ltd China
Euro Support Advanced Materials Netherlands Induceramic Canada
Innovative Research & Products Inc CT
Kanthal Heating Systems NY
MRA Laboratories Inc MA
Murata Manufacturing Co Ltd Japan
Polymer Innovations Inc CA **See ad page 41**
Sharp Corp Japan
Terio Corp China

Ceramic-Brazed Assemblies
AdTech Ceramics TN
CeramTec North America Corp SC
Enterprise Personnel CO
Induceramic Canada
Morgan Technical Ceramics Auburn CA
Precision Ferrites & Ceramics Inc CA

Conductors
AdTech Ceramics TN
Advanced Materials Technologies PA
ESL ElectroScience PA
fuelcellmaterials.com OH
Master Bond Inc NJ
NorECs AS Norway
TFD Inc CA

Crystals
GFI Advanced Technologies Inc NJ
Induceramic Canada
Konoshima Chemical Co Ltd Japan
Kyocera Intl Inc CA
Momentive Performance Materials Inc NY
MSE Supplies AZ
Sharp Corp Japan
Superconix Inc MN
TevTech LLC MA **See ad page 72**

Dielectrics
Adamant Co Ltd Japan
Advanced Materials Technologies PA
Alstom Grid Research & Technology UK
AVX Corp SC
Centerline Technologies MA
DuPont Electronic Technologies NC
ENrG Inc NY
Enterprise Personnel CO
ESL ElectroScience PA
Euro Support Advanced Materials Netherlands
FelCom LLC OR
Fraunhofer-Inst Silicatforschung ISC Germany
Friatec AG Germany
Gwent Electronic Materials Ltd UK
Morgan Advanced Materials CA
MRA Laboratories Inc MA
National Magnetics Group Inc PA
NGK Spark Plug Co Ltd Japan
Olevsk Porcelain Plant Ukraine
Pacific Ceramics Inc CA
Prolec SA de CV Mexico
Quartzite Processing Inc MA
SCP Ltd IN
Sharp Corp Japan
Thales TRT CA
Trans-Tech Inc MD

Ferrites & Ferromagnetics
Advanced Ceramic Technology CA
Ferro Ceramic Grinding Inc MA
Fraunhofer-Inst Silicatforschung ISC Germany
National Magnetics Group Inc PA
Pacific Ceramics Inc CA
Polymer Innovations Inc CA **See ad page 41**
Precision Ferrites & Ceramics Inc CA
Quartzite Processing Inc MA
Spontaneous Materials CO
Thales TRT CA
Trans-Tech Inc MD

Filters, Dielectric
Euro Support Advanced Materials Netherlands
Murata Manufacturing Co Ltd Japan
National Magnetics Group Inc PA
Olevsk Porcelain Plant Ukraine
Trans-Tech Inc MD

Fuel Cells, Solid Oxide
AdTech Ceramics TN
Associated Ceramics & Technology Inc PA
Bharat Heavy Electricals Ltd India
Ceramatec Inc UT
Chaozhou Three-Circle Co Ltd China
ENrG Inc NY
Enterprise Personnel CO
ESL ElectroScience PA
Euro Support Advanced Materials Netherlands
Fraunhofer-Inst Silicatforschung ISC Germany
fuelcellmaterials.com OH
Gwent Electronic Materials Ltd UK
HC Starck GmbH Germany
HC Starck Surface Technology & Ceramic Powders GmbH Germany
Innovative Research & Products Inc CT
Morgan Technical Ceramics Auburn CA
Nexceris LLC OH
NorECs AS Norway
Polymer Innovations Inc CA **See ad page 41**

Praxair Specialty Ceramics IN **See ad page 45**
Terio Corp China
Trans-Tech Inc MD

High-Voltage Insulators
Akron Porcelain & Plastics Co OH
Bharat Heavy Electricals Ltd India
Ceramco Inc NH
CeramTec North America Corp SC
Du-Co Ceramics Co PA
KC Industries Pty Ltd Australia
Maruti Refractories India
Maruwa Ceramic Co Ltd Japan
Morgan Technical Ceramics Auburn CA
Olevsk Porcelain Plant Ukraine
Precision Ferrites & Ceramics Inc CA
Prolec SA de CV Mexico
Xiamen Innovacera Advanced Materials Co China

Hybrid Circuits & Packages
AdTech Ceramics TN
Advanced Materials Technologies PA
AVX Corp SC
DuPont Electronic Technologies NC
Precision Ferrites & Ceramics Inc CA
Sharp Corp Japan
Xiamen Innovacera Advanced Materials Co China

IC Packages
AdTech Ceramics TN
Advanced Materials Technologies PA
Chaozhou Three-Circle Co Ltd China
Fraunhofer-Inst Silicatforschung ISC Germany
Innovative Research & Products Inc CT
Kyocera America Inc CA
Kyocera Intl Inc CA
NGK Spark Plug Co Ltd Japan
Sharp Corp Japan

Insulators, Electrical/Electronic
Accuratus Corp NJ
AdTech Ceramics TN
AdValue Technology LLC AZ **See ad page 55**
Akron Porcelain & Plastics Co OH
Alstom Grid Research & Technology UK
Blasch Precision Ceramics Inc NY
Ceramco Inc NH
Ceramic Oxide Fabricators Pty Ltd Australia
CeramTec North America Corp SC
CerCo LLC OH
Du-Co Ceramics Co PA
ER Advanced Ceramics Inc OH
ESL ElectroScience PA
Federal-Mogul MI
FelCom LLC OR
Ferro Ceramic Grinding Inc MA
KC Industries Pty Ltd Australia
Maruti Refractories India
Maruwa Ceramic Co Ltd Japan
Maryland Ceramic & Steatite Co Inc MD
Materion Ceramics AZ
Morgan Technical Ceramics Auburn CA
NEVZ-Ceramics, Close JSC Russia
Olevsk Porcelain Plant Ukraine
P-Ker Engineering NY
Precision Ferrites & Ceramics Inc CA
Prolec SA de CV Mexico
Sonya Ceramics (Export Div) India
Superior Technical Ceramics Corp VT
Toto Ltd Japan
Trans-Tech Inc MD
Triangle Ceramics NC
Xiamen Innovacera Advanced Materials Co China
Zircoa Inc OH

Integrated Passive Components: R,C,L
DuPont Electronic Technologies NC
Innovative Research & Products Inc CT
Sharp Corp Japan
Thales TRT CA

Magnets
Innovative Research & Products Inc CT
National Magnetics Group Inc PA
Spontaneous Materials CO

Microwave Packages
AdTech Ceramics TN
Chaozhou Three-Circle Co Ltd China
Enterprise Personnel CO
Kyocera America Inc CA
Kyocera Intl Inc CA
Precision Ferrites & Ceramics Inc CA
Sharp Corp Japan

Multilayer Ceramic Capacitors
Enterprise Personnel CO
Euro Support Advanced Materials Netherlands
Murata Manufacturing Co Ltd Japan
Polymer Innovations Inc CA **See ad page 41**

Sharp Corp Japan
Terio Corp China

Multilayer Ceramics, AlN
AdTech Ceramics TN
Kyocera America Inc CA
NEVZ-Ceramics, Close JSC Russia
Xiamen Innovacera Advanced Materials Co China

Multilayer Ceramics, Custom
AdTech Ceramics TN
Chaozhou Three-Circle Co Ltd China
EBL Products Inc CT
ENrG Inc NY
Euro Support Advanced Materials Netherlands
Kyocera America Inc CA
Xiamen Innovacera Advanced Materials Co China

Piezoelectrics
APC Intl Ltd PA
AVX Corp SC
EBL Products Inc CT
EDO Corp UT
Fraunhofer-Inst Silicatforschung ISC Germany
Innovative Research & Products Inc CT
Meggitt Piezo Technologies IN
Morgan Advanced Materials CA
Polymer Innovations Inc CA **See ad page 41**
Sparkler Ceramics Pvt Ltd India
Superconix Inc MN
Terio Corp China
Thales TRT CA

Pyroelectrics
Advanced Materials Technologies PA

Resistors, Thick-Film
Chaozhou Three-Circle Co Ltd China
DuPont Electronic Technologies NC
ESL ElectroScience PA
Kanthal Heating Systems NY
KC Industries Pty Ltd Australia
Murata Manufacturing Co Ltd Japan
Olevsk Porcelain Plant Ukraine
Polymer Innovations Inc CA **See ad page 41**
Terio Corp China

Resonators
AVX Corp SC
Murata Manufacturing Co Ltd Japan
National Magnetics Group Inc PA
NGK Spark Plug Co Ltd Japan
Trans-Tech Inc MD

rf Components
AdTech Ceramics TN
Advanced Energy CO **Inside front cover**
Kyocera America Inc CA
Murata Manufacturing Co Ltd Japan
Precision Ferrites & Ceramics Inc CA
Sharp Corp Japan

Semiconductors
GFI Advanced Technologies Inc NJ
NEVZ-Ceramics, Close JSC Russia
SCI Engineered Materials Inc OH
Semiconductor Energy Laboratory Co Ltd Japan
Sharp Corp Japan
Superconix Inc MN
Terio Corp China
TFD Inc CA
Toto Ltd Japan
Triangle Ceramics NC

Sensors
AdTech Ceramics TN
Advanced Materials Technologies PA
AVX Corp SC
Bullen OH
Ceramatec Inc UT
Ceramic Oxide Fabricators Pty Ltd Australia
CeramTec North America Corp SC
DuPont Electronic Technologies NC
EBL Products Inc CT
EDO Corp UT
ENrG Inc NY
GE Healthcare WI
Gwent Electronic Materials Ltd UK
Murata Manufacturing Co Ltd Japan
Neoptix Canada

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· Air Emission Issues in Glass Melting Furnaces
· Bioceramics: Advances and Challenges for Affordable Healthcare

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The American Ceramic Society
www.ceramics.org

Optocon AG Germany
Polymer Innovations Inc CA **See ad page 41**
Quality Thermistor Inc ID
Sharp Corp Japan
Sparkler Ceramics Pvt Ltd India
Technisonic Research Inc CT
Terio Corp China

Spark Plugs
Associated Ceramics & Technology Inc PA
CerCo LLC OH
Federal-Mogul MI
Gwent Electronic Materials Ltd UK
KC Industries Pty Ltd Australia
NGK Spark Plug Co Ltd Japan
Terio Corp China

Substrates, Alumina
Accuratus Corp NJ
Bullen OH
Centerline Technologies MA
CeramTec North America Corp SC
Chaozhou Three-Circle Co Ltd China
CoorsTek CO
Du-Co Ceramics Co PA
Ferro Ceramic Grinding Inc MA
Kyocera Industrial Ceramics Corp NC
Laserage Technology Corp IL
National Magnetics Group Inc PA
NEVZ-Ceramics, Close JSC Russia
NGK Spark Plug Co Ltd Japan
Ortech Inc CA **See ad page 43**
Saint-Gobain NorPro Corp OH
Sasol North America Inc AZ
Sonic-Mill NM
Superconix Inc MN
Tape Casting Consultants Inc PA
Toto Ltd Japan
Triangle Ceramics NC
Valley Design Corp MA
Xiamen Innovacera Advanced Materials Co China

Substrates, Aluminum Nitride
Accuratus Corp NJ
AdTech Ceramics TN
Bullen OH
Centerline Technologies MA
Chaozhou Three-Circle Co Ltd China
Kyocera Industrial Ceramics Corp NC
Laserage Technology Corp IL
Maruwa Ceramic Co Ltd Japan
MSE Supplies AZ
NEVZ-Ceramics, Close JSC Russia
Ortech Inc CA **See ad page 43**
Sonic-Mill NM
Starfire Systems Inc NY
Superconix Inc MN
Tape Casting Consultants Inc PA
Triangle Ceramics NC
Valley Design Corp MA
Xiamen Innovacera Advanced Materials Co China

Substrates, Glass
Accuratus Corp NJ
Centerline Technologies MA
Laserage Technology Corp IL
Saint-Gobain Recherche CA
Sem-Com Co Inc OH
Sonic-Mill NM

Substrates, Other
Akron Porcelain & Plastics Co OH
Alstom Grid Research & Technology UK
Bullen OH
Centerline Technologies MA
ENrG Inc NY
fuelcellmaterials.com OH
GFI Advanced Technologies Inc NJ
Maruwa Ceramic Co Ltd Japan
MSE Supplies AZ
NGK Spark Plug Co Ltd Japan
Sonic-Mill NM
Thales TRT CA
Trans-Tech Inc MD
Valley Design Corp MA
Zircar Zirconia Inc NY

Substrates, Silicon Carbide
Bullen OH
Centerline Technologies MA
Ferro Ceramic Grinding Inc MA
Ortech Inc CA **See ad page 43**
Sonic-Mill NM
Superconix Inc MN
Tape Casting Consultants Inc PA
Tenmat Ltd UK
Toto Ltd Japan
Triangle Ceramics NC
Valley Design Corp MA

Superconductors, High-Temperature
ENrG Inc NY
Innovative Research & Products Inc CT
Xiamen Innovacera Advanced Materials Co China

Tapes
Du-Co Ceramics Co PA
DuPont Electronic Technologies NC
ESL ElectroScience PA
Euro Support Advanced Materials Netherlands
Haiku Tech Europe BV Netherlands
Haiku Tech Inc FL
Vitta Corp CT

Thermistors
AVX Corp SC
Gwent Electronic Materials Ltd UK
Kanthal Heating Systems NY
Murata Manufacturing Co Ltd Japan
Polymer Innovations Inc CA **See ad page 41**
Quality Thermistor Inc ID

Transducers
APC Intl Ltd PA
CSC Force Measurement Inc MA
EBL Products Inc CT
Height Electronic Co China
Meggitt Piezo Technologies IN
Neoptix Canada
Sparkler Ceramics Pvt Ltd India
Technisonic Research Inc CT

Transformers
EDO Corp UT
Magnetic Specialities Inc PA
Prolec SA de CV Mexico
RoMan Manufacturing MI
Thales TRT CA
Warner Power LLC NH

Ultrasonic Ceramics
APC Intl Ltd PA
EBL Products Inc CT
Meggitt Piezo Technologies IN
Micromechatronics Inc PA
Sonic-Mill NM
Thales TRT CA

Varistors
AVX Corp SC
Kyocera Intl Inc CA
Polymer Innovations Inc CA **See ad page 41**

FABRICATING & FINISHING

Abrasives
Accurate Diamond Tool Corp NJ
Action Superabrasives OH
Advanced Superabrasives NV
Allied High Tech Products Inc CA
Diacut Inc CO
Diamond Industrial Tools Inc IL
Dunhua Zhengxing Abrasive Co Ltd China
Dynacut Inc PA
Electro Abrasives Corp NY
Elizabeth Carbide Die Co Inc PA
Emtas Abrasive Products Turkey
Engis Corp IL
Feldco Intl CA
Global Superabrasives AZ
Guyson Intl Ltd UK
GV Service Inc NY
Hygan Products Ltd UK
Industrial Tools Inc CA
Jet Edge Waterjet Systems MN
KC Abrasive Co KS
Lunzer Technologies Inc NY
Oglebay Norton Industrial Sands OH
Pryor Giggey Co AL
Reade Advanced Materials RI
Regal Diamond Products OH
Saint-Gobain Abrasives MA
Shahak & Co Diamond Tools Ltd Israel
Sigmadiamant Spain
Stahli USA Inc IL
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Washington Mills Electro Minerals Co NY
Wintech Diamonds Products India

Annealing Lehrs
Casso-Solar Technologies NY

Brickmaking Equipment
Basic Machinery Co Inc NC
Beamalloy Technologies LLC OH
Laeis GmbH Luxembourg
Manufacturers Equipment Co OH
Mohr Corp MI **See ad page 81**
Stedman Machine Co IN

Casting Equipment, Pressure
American Isostatic Presses OH
Cerinnov France
Cerlase France
Dorst America Inc PA
HED Intl Inc NJ
Laguna Clay Co CA
Maryland Ceramic & Steatite Co Inc MD
Mohr Corp MI **See ad page 81**

Casting Equipment, Slip
Hygan Products Ltd UK
Mohr Corp MI **See ad page 81**
Peltsman Corp MN

Casting Equipment, Tape
Haiku Tech Europe BV Netherlands
Haiku Tech Inc FL
HED Intl Inc NJ
Mohr Corp MI **See ad page 81**
Pacific Trinetics Corp (PTC) CA
Polymer Innovations Inc CA **See ad page 41**
Tape Casting Consultants Inc PA
Tape Casting Warehouse Div PA

CNC Mills
Cavco Machine Tool Rebuilding CT
Liberty Machinery Co IL
Lunzer Technologies Inc NY
OptiPro Systems LLC NY
Reliance Tool & Manufacturing IL
Suntech Advanced Ceramics (Shenzhen) Co Ltd China

Coating Equipment
Allied High Tech Products Inc CA
Casso-Solar Technologies NY
Cerakote Ceramic Coatings OR
Dynacut Inc PA
Haiku Tech Europe BV Netherlands
Haiku Tech Inc FL
Liberty Machinery Co IL
Manufacturers Equipment Co OH
Mohr Corp MI **See ad page 81**
Pacific Trinetics Corp (PTC) CA
UV Process Supply Inc IL

Coating Supplies
Phoenix Coating Resources Inc FL

Cold-End Coatings, Glass
Renite Co OH

Controllers
Dorst America Inc PA
General Glass Equipment Co NJ
Kaeser Compressors Inc VA
Laguna Clay Co CA
Rockwell Automation Inc WI

Cutting Equipment
Basic Machinery Co Inc NC
Cavco Machine Tool Rebuilding CT
Diamond Industrial Tools Inc IL

GW Schultz Tool FL
General Glass Equipment Co NJ
Haiku Tech Inc FL
Jet Edge Waterjet Systems MN
Liberty Machinery Co IL
Lunzer Technologies Inc NY
OptiPro Systems LLC NY
Pacific Trinetics Corp (PTC) CA
Sigmadiamant Spain
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Wintech Diamonds Products India

Cutting Tools
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Diacut Inc CO
Dynacut Inc PA
Engis Corp IL
GW Schultz Tool FL
Industrial Ceramic Technology MI
Industrial Tools Inc CA
Jet Edge Waterjet Systems MN
Logomatic GmbH Germany
Lunzer Technologies Inc NY
Manufacturers Equipment Co OH
New Tech Ceramics Inc IA
Shahak & Co Diamond Tools Ltd Israel
Sigmadiamant Spain
Well Diamond Wire Saws Inc GA
Wintech Diamonds Products India

CVD Equipment
Advanced Energy CO **Inside front cover**
Capovani Brothers Inc NY
Centorr Vacuum Industries Inc NH
GT Advanced Technologies (formerly Thermal Technology) CA
Liberty Machinery Co IL

Deburring Equipment
Engis Corp IL
Hygan Products Ltd UK
Industrial Tools Inc CA
Liberty Machinery Co IL
Lunzer Technologies Inc NY
Sweco KY

Diamond Drills
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Diamond Industrial Tools Inc IL
Greenlee Diamond Tool Co IL
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel
UKAM Industrial Superhard Tools CA
Wintech Diamonds Products India

Diamond Hones
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Diamond Industrial Tools Inc IL
Engis Corp IL
Greenlee Diamond Tool Co IL
Industrial Tools Inc CA
Saint-Gobain Abrasives MA
Shahak & Co Diamond Tools Ltd Israel
Stahli USA Inc IL
Wintech Diamonds Products India

Diamond Saw Blades
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Allied High Tech Products Inc CA
Aremco Products Inc NY
Comtrust Architectural Mesh Co Ltd China
Diacut Inc CO
Diamond Industrial Tools Inc IL
Dynacut Inc PA
Emtas Abrasive Products Turkey
Engis Corp IL
Greenlee Diamond Tool Co IL
GV Service Inc NY
Industrial Tools Inc CA
LECO Corp MI
Liberty Machinery Co IL
Logomatic GmbH Germany
Lunzer Technologies Inc NY
Saint-Gobain Abrasives MA
Texers Technical Ceramics Inc Canada
UKAM Industrial Superhard Tools CA
US Foam Corp OH
Well Diamond Wire Saws Inc GA
Wintech Diamonds Products India

Diamond Saws
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Allied High Tech Products Inc CA
Aremco Products Inc NY
Diacut Inc CO
Dynacut Inc PA
Greenlee Diamond Tool Co IL
Industrial Tools Inc CA
Liberty Machinery Co IL
Logomatic GmbH Germany
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel

Diamond Tools
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Diamond Industrial Tools Inc IL
Die Quip Corp PA
Engis Corp IL
Greenlee Diamond Tool Co IL
GV Service Inc NY
Industrial Tools Inc CA
LECO Corp MI
Lunzer Technologies Inc NY
Regal Diamond Products OH
Saint-Gobain Abrasives MA
Shahak & Co Diamond Tools Ltd Israel
Sigmadiamant Spain
UKAM Industrial Superhard Tools CA
Well Diamond Wire Saws Inc GA
Wintech Diamonds Products India

Dicing Equipment
Aremco Products Inc NY
Capovani Brothers Inc NY
Cavco Machine Tool Rebuilding CT
Diacut Inc CO
Diamond Industrial Tools Inc IL
Dynacut Inc PA
Liberty Machinery Co IL
Logomatic GmbH Germany
UKAM Industrial Superhard Tools CA

Dies
Gasbarre Products (PTX Pentronix) PA See ad page 81
Industrial Ceramic Technology MI
Infinity Stamps Inc CA
North Star Equipment Inc WA
Peltsman Corp MN
Ram Products Inc OH
Reliance Tool & Manufacturing IL

Dressing Wheels, Diamond
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Diacut Inc CO
Diamond Industrial Tools Inc IL
Dynacut Inc PA
Engis Corp IL
Greenlee Diamond Tool Co IL
Intelligent Micro Patterning LLC FL
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel

Electroplating Equipment
Haiku Tech Inc FL
Liberty Machinery Co IL

Extruders
Aadvanced Machinery Inc MI
American Art Clay Co Inc IN
Basic Machinery Co Inc NC
CERIC Technologies France
CW Brabender Instruments Inc NJ
Detroit Process Machinery MI
Dorst America Inc PA
Ipsen Ceramics IL
Laguna Clay Co CA
Manufacturers Equipment Co OH
Mohr Corp MI **See ad page 81**
North Star Equipment Inc WA
Peter Pugger Manufacturing Inc CA
Process Engineering Services TX

Feeders
Dover Conveyor Inc OH
Isoform Ltd UK
Manufacturers Equipment Co OH
Wyssmont Co NJ

Forming Equipment
American Isostatic Presses OH
ARBURG GmbH & Co KG Germany
CERIC Technologies France
Dorst America Inc PA
Engineered Pressure Systems Inc MA
HED Intl Inc NJ
Ipsen Ceramics IL
Isoform Ltd UK
Lithoz GmbH Austria
Manufacturers Equipment Co OH
Mohr Corp MI **See ad page 81**
North Star Equipment Inc WA
Peltsman Corp MN
Quintus Technologies LLC OH
Ram Products Inc OH

Glass Finishing Equipment
Casso-Solar Technologies NY
General Glass Equipment Co NJ
Krautzberger NA LLC VA
Liberty Machinery Co IL
Lithoz GmbH Austria
Lunzer Technologies Inc NY
OptiPro Systems LLC NY

Glass Forming Equipment
BDF Industries Italy
Casso-Solar Technologies NY
General Glass Equipment Co NJ
Lunzer Technologies Inc NY
Magnetic Specialities Inc PA
Renite Co OH

Glass Shear Spray
Renite Co OH

Glass Supplies
BDF Industries Italy
Ipsen Ceramics IL
Renite Co OH

Grinders, Centerless
Cavco Machine Tool Rebuilding CT
Diamond Industrial Tools Inc IL
Liberty Machinery Co IL
Logomatic GmbH Germany
Precision Ferrites & Ceramics Inc CA
Suntech Advanced Ceramics (Shenzhen) Co Ltd China

Grinders, Cylindrical
Diamond Industrial Tools Inc IL
Liberty Machinery Co IL
Logomatic GmbH Germany
Reliance Tool & Manufacturing IL
Suntech Advanced Ceramics (Shenzhen) Co Ltd China

Grinders, Finished Product
Cavco Machine Tool Rebuilding CT
DCM Tech MN
Ipsen Ceramics IL
Liberty Machinery Co IL
Logomatic GmbH Germany
OptiPro Systems LLC NY
Stahli USA Inc IL

Grinding Wheels
Accurate Diamond Tool Corp NJ
Action Superabrasives OH
Advanced Superabrasives NV
Allied High Tech Products Inc CA
Diacut Inc CO
Diamond Industrial Tools Inc IL
Die Quip Corp PA
Dynacut Inc PA
Emtas Abrasive Products Turkey
Engis Corp IL
Friatec AG Germany
Greenlee Diamond Tool Co IL
Industrial Tools Inc CA

Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel
Sigmadiamant Spain
Stahli USA Inc IL

Hydraulic Systems
Cavco Machine Tool Rebuilding CT
Isoform Ltd UK
Ram Products Inc OH

Injection-Molding Equipment
ARBURG GmbH & Co KG Germany
Goceram AB Sweden
Peltsman Corp MN
Rockwell Automation Inc WI
Suntech Advanced Ceramics (Shenzhen) Co Ltd China

Jiggering Equipment
Cerinnov France
Ram Products Inc OH

Lapping Equipment
Allied High Tech Products Inc CA
Capovani Brothers Inc NY
Cavco Machine Tool Rebuilding CT
Diamond Industrial Tools Inc IL
Die Quip Corp PA
Dynacut Inc PA
Engis Corp IL
Industrial Tools Inc CA
Liberty Machinery Co IL
OptiPro Systems LLC NY
Sigmadiamant Spain
Stahli USA Inc IL
UKAM Industrial Superhard Tools CA

Lapping Supplies
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Allied High Tech Products Inc CA
Diamond Industrial Tools Inc IL
Die Quip Corp PA
Dunhua Zhengxing Abrasive Co Ltd China
Emtas Abrasive Products Turkey
Engis Corp IL
Feldco Intl CA
KC Abrasive Co KS
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel
Stahli USA Inc IL
UKAM Industrial Superhard Tools CA

Laser Scribers
Cavco Machine Tool Rebuilding CT
Centerline Technologies MA
Cerlase France
Laserage Technology Corp IL
Strico AG Switzerland

Machining Equipment
Cavco Machine Tool Rebuilding CT
Dynacut Inc PA
Ferro Ceramic Grinding Inc MA
Ikonics Imaging-Industrial Solutions MN
Intl Ceramic Engineering MA
Liberty Machinery Co IL
OptiPro Systems LLC NY
Reliance Tool & Manufacturing IL
Stahli USA Inc IL
UKAM Industrial Superhard Tools CA

Mandrels, Diamond
Accurate Diamond Tool Corp NJ
Advanced Superabrasives NV
Diacut Inc CO
Diamond Industrial Tools Inc IL
Engis Corp IL
Greenlee Diamond Tool Co IL
Logomatic GmbH Germany
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel
UKAM Industrial Superhard Tools CA

Molds, Case
JACPA Ceramic Craftsmen MI
Petro Mold Co PA
Ram Products Inc OH

Molds, Ceramic-Forming
Akron Porcelain & Plastics Co OH
Ceramaret SA Switzerland
Cerinnov France
Cerlase France
Goceram AB Sweden
Ipsen Ceramics IL
Isoform Ltd UK
JACPA Ceramic Craftsmen MI
Laeis GmbH Luxembourg
Laguna Clay Co CA
Peltsman Corp MN
Petro Mold Co PA
Ram Products Inc OH
Viridis3D LLC MA

Molds, Models
JACPA Ceramic Craftsmen MI
Petro Mold Co PA
Ram Products Inc OH
Viridis3D LLC MA

Plasma Etching Systems
Advanced Energy CO **Inside front cover**
Capovani Brothers Inc NY
Liberty Machinery Co IL
Logomatic GmbH Germany

Pneumatic Systems
Cyclonaire Corp NE
Peltsman Corp MN
Ram Products Inc OH
Young Industries Inc PA

Polishing Equipment
Allied High Tech Products Inc CA
Capovani Brothers Inc NY
Diamond Industrial Tools Inc IL
Dynacut Inc PA
Engis Corp IL
Industrial Tools Inc CA
LECO Corp MI
Liberty Machinery Co IL
OptiPro Systems LLC NY
Sigmadiamant Spain
Stahli USA Inc IL

Polishing Powder & Supplies
Advanced Superabrasives NV
Baikowski Malakoff Inc NC
C&L Development Corp CA
Engis Corp IL
KC Abrasive Co KS
Lunzer Technologies Inc NY
Sasol North America Inc AZ
Shahak & Co Diamond Tools Ltd Israel
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Gasbarre Products (PTX Pentronix) MI **See ad page 81**
Mohr Corp MI **See ad page 81**
Quintus Technologies LLC OH
Sahut Conreur SA France

Presses, Dry
Aadvanced Machinery Inc MI
Dorst America Inc PA
Gasbarre Products (PTX Pentronix) PA **See ad page 81**
Maryland Ceramic & Steatite Co Inc MD
Mohr Corp MI **See ad page 81**
Suntech Advanced Ceramics (Shenzhen) Co Ltd China

Presses, Extrusion
Dorst America Inc PA
Maryland Ceramic & Steatite Co Inc MD
Mohr Corp MI **See ad page 81**
Peter Pugger Manufacturing Inc CA

Presses, Hot
American Isostatic Presses OH
Centorr Vacuum Industries Inc NH
FCT Ingenieurkeramik GmbH Germany
FCT Systeme GmbH Germany
GT Advanced Technologies (formerly Thermal Technology) CA
Materials Research Furnaces Inc NH **See ad page 74**
Mohr Corp MI **See ad page 81**
Oxy-Gon Industries Inc NH
Refrac Systems AZ

Presses, Hot Isostatic
American Isostatic Presses OH
AVS Inc MA
Engineered Pressure Systems Inc MA
FCT Ingenieurkeramik GmbH Germany
Mohr Corp MI **See ad page 81**
Quintus Technologies LLC OH

Presses, Hydraulic
Aadvanced Machinery Inc MI
ARBURG GmbH & Co KG Germany
AVS Inc MA
Digital Press Inc PA
Dorst America Inc PA
Gasbarre Products (PTX Pentronix) PA **See ad page 81**
Laeis GmbH Luxembourg
Materials Research Furnaces Inc NH **See ad page 74**
Mohr Corp MI **See ad page 81**
Process Engineering Services TX
Ram Products Inc OH

Presses, Isostatic
Aadvanced Machinery Inc MI
American Isostatic Presses OH
Cerlase France
Detroit Process Machinery MI
Dorst America Inc PA
Engineered Pressure Systems Inc MA

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Gasbarre Products (PTX Pentronix) MI **See ad page 81**
Haiku Tech Europe BV Netherlands
Haiku Tech Inc FL
Isoform Ltd UK
Mohr Corp MI **See ad page 81**
Pacific Trinetics Corp (PTC) CA
Quintus Technologies LLC OH
RocCera LLC NY
Suntech Advanced Ceramics (Shenzhen) Co Ltd China
Triangle Ceramics NC

Presses, Other
ARBURG GmbH & Co KG Germany
Isoform Ltd UK

Presses, Pressure Casting
Dorst America Inc PA
Peter Pugger Manufacturing Inc CA
Ram Products Inc OH

Presses, Refractory Shapes
Engineered Pressure Systems Inc MA
Laeis GmbH Luxembourg

Presses, Rotary
Aadvanced Machinery Inc MI
Materials Research Furnaces Inc NH **See ad page 74**

Presses, Tile (Ceramic)
Laeis GmbH Luxembourg
North Star Equipment Inc WA
Peter Pugger Manufacturing Inc CA

Pug Mills
Aadvanced Machinery Inc MI
Basic Machinery Co Inc NC
Dorst America Inc PA
Mohr Corp MI **See ad page 81**
Peter Pugger Manufacturing Inc CA
Process Engineering Services TX
Sheffield Pottery MA
Young Industries Inc PA

PVD Equipment
Beamalloy Technologies LLC OH
Capovani Brothers Inc NY
Liberty Machinery Co IL
Teeter Marketing Services LLC FL

Roll Compaction
Sahut Conreur SA France

Roofing Tile Machinery
Laeis GmbH Luxembourg
Mohr Corp MI **See ad page 81**

Setting Equipment
Basic Machinery Co Inc NC

Slab Rollers
North Star Equipment Inc WA

Sponges
Hygan Products Ltd UK
US Foam Corp OH

Spray Booths
Krautzberger NA LLC VA

Sputtering Equipment
Advanced Energy CO **Inside front cover**
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NV Bekaert SA Belgium
SCI Engineered Materials Inc OH

Superabrasives
Accurate Diamond Tool Corp NJ
Action Superabrasives OH
Advanced Superabrasives NV
Diamond Industrial Tools Inc IL
Dynacut Inc PA
Emtas Abrasive Products Turkey
Engis Corp IL
Global Superabrasives AZ
Greenlee Diamond Tool Co IL
Industrial Tools Inc CA
Liberty Machinery Co IL
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel
Teeter Marketing Services LLC FL

Surface Modification Systems
Beamalloy Technologies LLC OH
Emtas Abrasive Products Turkey
Ikonics Imaging-Industrial Solutions MN
Krautzberger NA LLC VA
Plasma Etch Inc NV
Teeter Marketing Services LLC FL

Tilemaking Equipment
Basic Machinery Co Inc NC
GV Service Inc NY
Lunzer Technologies Inc NY
Manufacturers Equipment Co OH
Mohr Corp MI **See ad page 81**
North Star Equipment Inc WA
Peter Pugger Manufacturing Inc CA

Tools, Modeling
Hygan Products Ltd UK
Sheffield Pottery MA
Viridis3D LLC MA

Turning Machines, Insulator
Liberty Machinery Co IL

Ultrasonic Machining Equipment
Bullen OH
OptiPro Systems LLC NY
Sonic-Mill NM

Used Equipment
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Basic Machinery Co Inc NC
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Dorst America Inc PA
Dynacut Inc PA
Intelligent Micro Patterning LLC FL
Liberty Machinery Co IL

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Process Engineering Services TX
Ram Products Inc OH
Viridis3D LLC MA

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Rockwell Automation Inc WI
Sweco KY

Wheels, Cutoff & Grinding
Accurate Diamond Tool Corp NJ
Action Superabrasives OH
Advanced Superabrasives NV
Diacut Inc CO
Diamond Industrial Tools Inc IL
Dynacut Inc PA
Emtas Abrasive Products Turkey
Engis Corp IL
Greenlee Diamond Tool Co IL
Industrial Tools Inc CA
LECO Corp MI
Liberty Machinery Co IL
Logomatic GmbH Germany
Shahak & Co Diamond Tools Ltd Israel

Wheels, Diamond
Accurate Diamond Tool Corp NJ
Action Superabrasives OH
Advanced Superabrasives NV
Aremco Products Inc NY
Diacut Inc CO
Dynacut Inc PA
Emtas Abrasive Products Turkey
Engis Corp IL
Greenlee Diamond Tool Co IL
GV Service Inc NY
Industrial Tools Inc CA
Lunzer Technologies Inc NY
Shahak & Co Diamond Tools Ltd Israel
Sigmadiamant Spain
Stahli USA Inc IL

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Emtas Abrasive Products Turkey
Mixer Systems Inc WI
Saint-Gobain Recherche CA

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Cincinnati Gasket OH
Decal Craft Canada
Elan Technology GA
Garg Process Glass India Pvt Ltd India
Glass Factory Directory of North America NY
Sem-Com Co Inc OH
Specialty Glass Inc FL
Strico AG Switzerland
Valley Design Corp MA

Canes, Glass
Glass Factory Directory of North America NY
Sem-Com Co Inc OH

Chemically Strengthened Glass
Arkema Inc PA
Garg Process Glass India Pvt Ltd India
Glass Factory Directory of North America NY
Saint-Gobain Recherche CA
Saxon Glass Technologies Inc NY
Sem-Com Co Inc OH
Vesuvius SC

Container Glass
Arkema Inc PA
Cerinnov France
Glass Factory Directory of North America NY
Mixer Systems Inc WI
Owens-Illinois Inc OH
Print Control Services LLC MA
Proscience Inc Canada
Saint-Gobain Recherche CA
Vesuvius SC

Fibers, Continuous
Eglasstrek Patent Promotion & Awarding GmbH Germany
Glass Factory Directory of North America NY
Saint-Gobain Recherche CA
Verity Technical Consultants LLC OH

Fibers, Optical
Adamant Co Ltd Japan
Corning Inc NY
Glass Factory Directory of North America NY
impactGlass Research Intl AZ
Optocon AG Germany
Sonic-Mill NM

Flat & Safety Glass
Arkema Inc PA
Cincinnati Gasket OH
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Glass Factory Directory of North America NY
Mixer Systems Inc WI
Saint-Gobain Recherche CA
Vesuvius SC

Fused-Silica Glass
Accuratus Corp NJ
Angstrom Precision Optics Inc NY
Arkema Inc PA
Bullen OH
Cincinnati Gasket OH
Dynasil Fused Silica NJ
Ferro Ceramic Grinding Inc MA
Imerys Refractory Minerals GA
impactGlass Research Intl AZ
Quartz Scientific Inc OH
Valley Design Corp MA

Glass-Ceramics
Accuratus Corp NJ
Advanced Ceramic Technology CA
Alstom Grid Research & Technology UK
Arkema Inc PA
Bullen OH
Cerlase France
Cincinnati Gasket OH
Cotronics Corp NY
Decal Craft Canada
Elan Technology GA
Fraunhofer-Inst Silicatforschung ISC Germany
Hefa Rare Earth Canada Co Ltd Canada
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Petro Mold Co PA
PremaTech Advanced Ceramics MA
Schott North America Inc KY
Sem-Com Co Inc OH
Specialty Glass Inc FL
StudioLX - Home Decor IL
TevTech LLC MA **See ad page 72**
Texers Technical Ceramics Inc Canada
Valley Design Corp MA
Xiamen Innovacera Advanced Materials Co China

Glass-to-Metal Seals
Alstom Grid Research & Technology UK
Elan Technology GA
ESL ElectroScience PA
Fraunhofer-Inst Silicatforschung ISC Germany
Glass Factory Directory of North America NY
Quartz Scientific Inc OH
Specialty Glass Inc FL

Laboratory & Technical Glass
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Arkema Inc PA
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Garg Process Glass India Pvt Ltd India
Glass Factory Directory of North America NY
LECO Corp MI
Proscience Inc Canada
Saxon Glass Technologies Inc NY
Specialty Glass Inc FL
Strainoptics Inc PA
TevTech LLC MA **See ad page 72**

Laminated Glass
Cincinnati Gasket OH
Glass Factory Directory of North America NY
Vesuvius SC

Laser Glasses
Angstrom Precision Optics Inc NY
Cerinnov France
Glass Factory Directory of North America NY
Israel Ceramic & Silicate Inst Israel

Lenses
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Dynasil Fused Silica NJ
Kyocera Industrial Ceramics Corp NC
Quartz Scientific Inc OH
TevTech LLC MA **See ad page 72**

Lighting
Cincinnati Gasket OH
Glass Factory Directory of North America NY
Osram Sylvania Inc MA

Mirrors
Angstrom Precision Optics Inc NY
Valley Design Corp MA

Optical & Optoelectronic Ceramics
Glass Factory Directory of North America NY
NEVZ-Ceramics, Close JSC Russia
Specialty Glass Inc FL
TevTech LLC MA **See ad page 72**
Vesuvius SC

Optical Substrates
Angstrom Precision Optics Inc NY
Bullen OH
Dynasil Fused Silica NJ
Eglasstrek Patent Promotion & Awarding GmbH Germany
Feldco Intl CA
GFI Advanced Technologies Inc NJ
Specialty Glass Inc FL
Valley Design Corp MA
Vesuvius SC

Optical Thin Films
Angstrom Precision Optics Inc NY
Eglasstrek Patent Promotion & Awarding GmbH Germany
Feldco Intl CA
TevTech LLC MA **See ad page 72**

Solar
Arkema Inc PA
Ceradyne Inc, a 3M Co WA **See ad page 51**
Feldco Intl CA
Glass Factory Directory of North America NY
Materion Ceramics AZ
TevTech LLC MA **See ad page 72**
Texers Technical Ceramics Inc Canada
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Corning Inc NY
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Fraunhofer-Inst Silicatforschung ISC Germany
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Garg Process Glass India Pvt Ltd India
Morgan Advanced Materials CA
Proscience Inc Canada
Quartz Scientific Inc OH
Sem-Com Co Inc OH
Specialty Glass Inc FL

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Arkema Inc PA
Bayville Chemical Supply Co Inc NY
Nanofilm OH
Presto Stantest Pvt Ltd India
RocCera LLC NY
Tape Casting Warehouse Div PA

Colorimeters
Cargille Labs NJ
Color-Tec NJ
Elektro Physik IL
HunterLab VA
UV Process Supply Inc IL

Density Measurement Instruments
AGR Intl Inc PA
Cargille Labs NJ
CW Brabender Instruments Inc NJ
Micromeritics Instrument Corp GA
Particle Technology Labs IL
Quantachrome Instruments FL
RocCera LLC NY
Universal Technical Equipment PA
UV Process Supply Inc IL

Detectors
Amptek Inc MA
Control Instruments Corp NJ
Rockwell Automation Inc WI
SE Intl Inc TN
Siemens Process Industries & Drives GA

Dimension Measurement Instruments
AGR Intl Inc PA
CSC Force Measurement Inc MA
Die Quip Corp PA
Elektro Physik IL
Precision Measurements & Instruments Corp OR

Dryers
Applied Test Systems Inc PA
Ceramic Services Inc PA
Cober Muegge LLC CT
Detroit Process Machinery MI
Goceram AB Sweden
Kaeser Compressors Inc VA
Lanly Co OH
Linn High Therm GmbH Germany
Littleford Day Inc KY
Micropyretics Heaters Intl Inc OH
PSC Inc OH
Recco Furnaces CA
Retsch Inc PA
ROmiLL sro Czech Republic
Wyssmont Co NJ

Fiberoptic Illuminators
Carl Zeiss Mircolmaging Inc NY
Die Quip Corp PA
Mo-Sci Corp MO **See ad page 83**
Strainoptics Inc PA
Taber Industries NY

Glassware
AdValue Technology LLC AZ **See ad page 55**
Garg Process Glass India Pvt Ltd India
Proscience Inc Canada
Quartz Scientific Inc OH

Glossimeters
Elektro Physik IL
Horiba Instruments Inc CA
UV Process Supply Inc IL

Hardness Measurement Instruments
Accurate Diamond Tool Corp NJ
Allied High Tech Products Inc CA
Buehler Ltd IL
Capovani Brothers Inc NY
Carl Zeiss Mircolmaging Inc NY
LECO Corp MI
Nanoscience Instruments AZ
Shimadzu Scientific Instruments MD
Taber Industries NY
UV Process Supply Inc IL

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Capovani Brothers Inc NY
Micropyretics Heaters Intl Inc OH
RocCera LLC NY
Zhengzhou Mission Ceramic Products Co Ltd China

Lab Crucibles
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Ceramic Oxide Fabricators Pty Ltd Australia
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Prairie Ceramics Corp CA
Robocasting Enterprises LLC NM
Xiamen Innovacera Advanced Materials Co China
Zhengzhou Mission Ceramic Products Co Ltd China

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AdValue Technology LLC AZ **See ad page 55**
Carbolite Inc WI **See ad page 69**
Ceramic Oxide Fabricators Pty Ltd Australia
McDanel Advanced Ceramic Technologies LLC PA
Nabertherm Inc DE
Prairie Ceramics Corp CA
Quartz Scientific Inc OH
Xiamen Innovacera Advanced Materials Co China
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GT Advanced Technologies (formerly Thermal Technology) CA
L&L Special Furnace Co Inc PA **See ad page 73**
Linn High Therm GmbH Germany
Lucifer Furnaces Inc PA
Materials Research Furnaces Inc NH **See ad page 74**
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Nabertherm Inc DE
Oxy-Gon Industries Inc NH
Paragon Industries LP TX
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Zhengzhou Mission Ceramic Products Co Ltd China
Zircar Ceramics Inc NY
Zircar Zirconia Inc NY

Light Sources
Allied High Tech Products Inc CA
Carl Zeiss Mircolmaging Inc NY
Spectronics Corp NY

Magnetic Separation Instruments
Dings Co WI
Russell Finex Inc NC

Magnetic Stirrers
UV Process Supply Inc IL

Mechanical Property Measurement Instruments
Applied Test Systems Inc PA
ATS RheoSystems, A Div of Cannon Instrument Co PA
Buehler Ltd IL
BuzzMac Intl LLC WI
CSC Force Measurement Inc MA
Elektro Physik IL
Nanoscience Instruments AZ
Shimadzu Scientific Instruments MD
TA Instruments DE **See ad page 99**
Taber Industries NY

Microscopes, Hot Stages
Carl Zeiss Mircolmaging Inc NY
Dalmia Inst of Scientific & Industrial Research India
TA Instruments DE **See ad page 99**

Microscopes, Interference
Buehler Ltd IL
Carl Zeiss Mircolmaging Inc NY

Microscopes, Other
AdValue Technology LLC AZ **See ad page 55**
Allied High Tech Products Inc CA
Capovani Brothers Inc NY
Carl Zeiss Mircolmaging Inc NY
Nanoscience Instruments AZ
TA Instruments DE **See ad page 99**
UV Process Supply Inc IL

Microscopes, Polarizing
Buehler Ltd IL
Carl Zeiss Mircolmaging Inc NY
JTF Microscopy Services Inc NY
Strainoptics Inc PA

Microscopes, Reflected Light
Allied High Tech Products Inc CA
Buehler Ltd IL
Capovani Brothers Inc NY
Carl Zeiss Mircolmaging Inc NY
LECO Corp MI
UV Process Supply Inc IL

Microscopes, Scanning Electron
Capovani Brothers Inc NY
Nanoscience Instruments AZ
SEMTech Solutions Inc MA

Microscopes, Transmission Electron
Horiba Instruments Inc CA

Mills, Laboratory
Advanced Ceramics Manufacturing AZ
Capovani Brothers Inc NY
Custom Processing Services PA
CW Brabender Instruments Inc NJ
Detroit Process Machinery MI
Exakt Technologies Inc OK
Fluid Energy Processing & Equipment Co PA
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Laval Lab Inc Canada
MSE Supplies AZ
Retsch Inc PA
Stedman Machine Co IN
Sturtevant Inc MA
Sweco KY
Tape Casting Warehouse Div PA
Union Process OH

Mixers, Laboratory
Capovani Brothers Inc NY
Custom Processing Services PA
Detroit Process Machinery MI
Dynamic Air Inc MN
Fritsch GmbH - Milling & Sizing Germany
Lancaster Products PA
Littleford Day Inc KY
Peltsman Corp MN
Peter Pugger Manufacturing Inc CA
Ram Products Inc OH
UV Process Supply Inc IL

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LECO Corp MI
Micromeritics Instrument Corp GA
Presto Stantest Pvt Ltd India
Soilmoisture Equipment Corp CA

Optical Comparitors
Die Quip Corp PA

Optical Property Measurement Instruments
AGR Intl Inc PA
Angstrom Precision Optics Inc NY
Cargille Labs NJ
Fritsch GmbH - Milling & Sizing Germany
Precision Measurements & Instruments Corp OR

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Horiba Instruments Inc CA
Mettler-Toledo Inc OH
Ocean Optics Inc FL
Presto Stantest Pvt Ltd India
Presto Testing Instruments India
UV Process Supply Inc IL

Photometric Measurement Instruments
Gigahertz-Optik Inc MA
Presto Stantest Pvt Ltd India

Polarimeters
Presto Stantest Pvt Ltd India
Strainoptics Inc PA

Porosimeters
Micromeritics Instrument Corp GA
Particle Technology Labs IL
Quantachrome Instruments FL

Powders Samplers
Fritsch Milling & Sizing PA
Quantachrome Instruments FL
Retsch Inc PA

Recorders
CSC Force Measurement Inc MA
Datapaq Inc NH
Rockwell Automation Inc WI
Siemens Process Industries & Drives GA

Rheometers
Ankersmid Particle Size & Shape NJ
ATS RheoSystems, A Div of Cannon Instrument Co PA
CW Brabender Instruments Inc NJ
Particle Technology Labs IL
Presto Stantest Pvt Ltd India
TA Instruments DE **See ad page 99**

Sample Preparation Equipment
Allied High Tech Products Inc CA
Buehler Ltd IL
Capovani Brothers Inc NY
Exakt Technologies Inc OK
Fluid Metering Inc NY
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Laval Lab Inc Canada
Linn High Therm GmbH Germany
Micromeritics Instrument Corp GA
Ram Products Inc OH
Retsch Inc PA

Thermometers
Optocon AG Germany
Xiamen Innovacera Advanced Materials Co China

Viscosity Measurement Instruments
ATS RheoSystems, A Div of Cannon Instrument Co PA
Capovani Brothers Inc NY
Cargille Labs NJ
Carl Zeiss Mircolmaging Inc NY
CW Brabender Instruments Inc NJ
Elektro Physik IL
Norcross Viscosity Controls MI
Rockwell Automation Inc WI
Shimadzu Scientific Instruments MD
TA Instruments DE **See ad page 99**
UV Process Supply Inc IL

Visual Inspection Instruments
AGR Intl Inc PA
Buehler Ltd IL
Die Quip Corp PA
Haiku Tech Inc FL
Strainoptics Inc PA
Taber Industries NY

Weighing/Scales
Amstat Industries Inc IL
CSC Force Measurement Inc MA
Emery Winslow Scale Co CT
Mettler-Toledo Inc OH
Rockwell Automation Inc WI
Shimadzu Scientific Instruments MD
Siemens Process Industries & Drives GA
UV Process Supply Inc IL

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Atomic Adsorption
Spectrochemical Laboratories PA

Auger Analysis
Evans Analytical Group LLC CA
High Temperature Materials Laboratory TN
Integrity Testing Laboratory Inc Canada
Micron Inc DE
Oneida Research Services Inc NY

Chemical Analysis
Activation Laboratories Ltd Canada
ATS RheoSystems, A Div of Cannon Instrument Co PA
CelSian Glass & Solar BV Netherlands
Chemir - A Div of Evans Analytical Group MO
Dalmia Inst of Scientific & Industrial Research India
Edward Orton Jr Ceramic Foundation OH
Evans Analytical Group LLC CA
Fraunhofer-Inst Silicatforschung ISC Germany
Geller Microanalytical Laboratory Inc MA
H&M Analytical Services Inc NJ
Hindalco Industries Ltd India
Impact Analytical MI
Integrity Testing Laboratory Inc Canada
Israel Ceramic & Silicate Inst Israel
Japan Fine Ceramics Center Japan
Lucideon UK
Northrop Grumman Corp VA
NSL Analytical Services Inc OH
Oneida Research Services Inc NY
Setaram Instrumentation France
SGS Minerals Services Canada
Technology of Materials CA
Washington Mills Electro Minerals Co NY

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Activation Laboratories Ltd Canada
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Imerys GA
Laguna Clay Co CA
Technology of Materials CA

Composition
Activation Laboratories Ltd Canada
Alfred University NY
CelSian Glass & Solar BV Netherlands
Chemir - A Div of Evans Analytical Group MO
Dalmia Inst of Scientific & Industrial Research India
Dannalab Netherlands
Edward Orton Jr Ceramic Foundation OH
Fraunhofer-Inst Silicatforschung ISC Germany
Industrial Testing Laboratories Inc MO
Japan Fine Ceramics Center Japan
North Star Imaging Inc MN
Northrop Grumman Corp VA
P-Ker Engineering NY
Rauschert Industries Inc TN
Sem-Com Co Inc OH
Tape Casting Consultants Inc PA
Viridis3D LLC MA

Corrosion Testing
Activation Laboratories Ltd Canada
Advanced NDT Ltd UK
All Waste Matters UK
CelSian Glass & Solar BV Netherlands
Chemir - A Div of Evans Analytical Group MO
Dalmia Inst of Scientific & Industrial Research India
Edward Orton Jr Ceramic Foundation OH
Fraunhofer-Inst Silicatforschung ISC Germany
Industrial Testing Laboratories Inc MO
Integrity Testing Laboratory Inc Canada
P-Ker Engineering NY
SEMTech Solutions Inc MA

Density Determination
Activation Laboratories Ltd Canada
AGR Intl Inc PA
AVEKA MN
Cargille Labs NJ
Chemir - A Div of Evans Analytical Group MO
Cyclonaire Corp NE
Edward Orton Jr Ceramic Foundation OH
Hindalco Industries Ltd India
Hysitron Inc MN
Integrity Testing Laboratory Inc Canada
Israel Ceramic & Silicate Inst Israel

Japan Fine Ceramics Center Japan
Micromeritics Instrument Corp GA
North Star Imaging Inc MN
NSL Analytical Services Inc OH
Particle Technology Labs IL
Quantachrome Instruments FL
SGS Minerals Services Canada

Differential Thermal Analysis

Activation Laboratories Ltd Canada
AGR Intl Inc PA
AVEKA MN
C-Therm Technologies Ltd Canada
Chemir - A Div of Evans Analytical Group MO
Edward Orton Jr Ceramic Foundation OH
Evans Analytical Group LLC CA
Fraunhofer-Inst Silicatforschung ISC Germany
High Temperature Materials Laboratory TN
Hindalco Industries Ltd India
Impact Analytical MI
Integrity Testing Laboratory Inc Canada
Japan Fine Ceramics Center Japan
Micron Inc DE
Netzsch Instruments NA LLC MA
Precision Measurements & Instruments Corp OR
Setaram Instrumentation France
TA Instruments DE **See ad page 99**
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Electron Microprobe Analysis

Activation Laboratories Ltd Canada
Fraunhofer-Inst Silicatforschung ISC Germany
High Temperature Materials Laboratory TN
Industrial Testing Laboratories Inc MO
Integrity Testing Laboratory Inc Canada
Japan Fine Ceramics Center Japan
Micron Inc DE
Rensselaer Polytechnic Inst NY
SGS Minerals Services Canada
Technology of Materials CA

Failure Analysis

AGR Intl Inc PA
Alstom Grid Research & Technology UK
Birney W West PE TX
Chemir - A Div of Evans Analytical Group MO
CMC Laboratories Inc AZ
CoorsTek CO
Edward Orton Jr Ceramic Foundation OH
EWI OH
Geller Microanalytical Laboratory Inc MA
H&M Analytical Services Inc NJ
High Temperature Materials Laboratory TN
Impact Analytical MI
Innalox BV Netherlands
Integrity Testing Laboratory Inc Canada
Japan Fine Ceramics Center Japan
JTF Microscopy Services Inc NY
Micron Inc DE
North Star Imaging Inc MN
NSL Analytical Services Inc OH
Oneida Research Services Inc NY
Rensselaer Polytechnic Inst NY
SEMTech Solutions Inc MA
Technology of Materials CA

Fracture Analysis

AGR Intl Inc PA
Chemir - A Div of Evans Analytical Group MO
CoorsTek CO
EWI OH
High Temperature Materials Laboratory TN
Innalox BV Netherlands
Japan Fine Ceramics Center Japan
JTF Microscopy Services Inc NY
Micron Inc DE
NSL Analytical Services Inc OH
QuantumSphere Inc CA
Rensselaer Polytechnic Inst NY
SEMTech Solutions Inc MA
Spectrochemical Laboratories PA

Interferometers

Angstrom Precision Optics Inc NY
Integrity Testing Laboratory Inc Canada
Lumetrics Inc NY
Precision Measurements & Instruments Corp OR

Materials Analysis

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Dannalab Netherlands
Edward Orton Jr Ceramic Foundation OH
Elan Technology GA
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Lock 3 Co PA
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MRA Laboratories Inc MA
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Northrop Grumman Corp VA
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Oneida Research Services Inc NY
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BuzzMac Intl LLC WI
Chemir - A Div of Evans Analytical Group MO
CSC Force Measurement Inc MA
Edward Orton Jr Ceramic Foundation OH
EWI OH
Gateway Materials Technology Inc IL
High Temperature Materials Laboratory TN
Hysitron Inc MN
Integrity Testing Laboratory Inc Canada
Japan Fine Ceramics Center Japan
Northrop Grumman Corp VA
Precision Measurements & Instruments Corp OR
Smaht Ceramics Inc UT
TA Instruments DE **See ad page 99**
Taber Industries NY

Nondestructive Testing

Advanced NDT Ltd UK
Cetek Ltd OH
EWI OH
SEMTech Solutions Inc MA

Optical Properties

Activation Laboratories Ltd Canada
AGR Intl Inc PA
Angstrom Precision Optics Inc NY
Cargille Labs NJ
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Integrity Testing Laboratory Inc Canada
Precision Measurements & Instruments Corp OR
Rensselaer Polytechnic Inst NY

Particle-Size Analysis

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AVEKA MN
Chemir - A Div of Evans Analytical Group MO
Custom Processing Services PA
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Fraunhofer-Inst Silicatforschung ISC Germany
Geller Microanalytical Laboratory Inc MA
H&M Analytical Services Inc NJ
Harper Intl NY
Haver & Boecker OHG Germany
Israel Ceramic & Silicate Inst Israel
Japan Fine Ceramics Center Japan
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Micron Inc DE
NSL Analytical Services Inc OH
Oneida Research Services Inc NY
P-Ker Engineering NY
Particle Technology Labs IL
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SGS Minerals Services Canada
Smaht Ceramics Inc UT
Technology Assessment & Transfer Inc (TA&T) MD
Technology of Materials CA
Washington Mills Electro Minerals Co NY

Pore Structure Analysis

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Japan Fine Ceramics Center Japan
Micromeritics Instrument Corp GA
P-Ker Engineering NY
Particle Technology Labs IL
Quantachrome Instruments FL
SEMTech Solutions Inc MA

Residual Stress Analysis

AGR Intl Inc PA
American Stress Technologies Inc PA
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Industrial Testing Laboratories Inc MO
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Strainoptics Inc PA
TA Instruments DE **See ad page 99**

Scanning Electron Microscopy

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Oneida Research Services Inc NY
SGS Minerals Services Canada
Spectrochemical Laboratories PA

Surface-Area Analysis
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AVEKA MN
Harper Intl NY
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Industrial Testing Laboratories Inc MO
Japan Fine Ceramics Center Japan
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Oneida Research Services Inc NY
Particle Technology Labs IL
Quantachrome Instruments FL
SEMTech Solutions Inc MA
Technology Assessment & Transfer Inc (TA&T) MD

Thermal Analysis
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Precision Measurements & Instruments Corp OR
Setaram Instrumentation France
TA Instruments DE **See ad page 99**
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Transmission Electron Microscopy
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Micron Inc DE
NSL Analytical Services Inc OH

Tribological Studies
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X-ray Diffraction
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Japan Fine Ceramics Center Japan
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NSL Analytical Services Inc OH
SGS Minerals Services Canada
Technology of Materials CA

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Sturtevant Inc MA

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Haver & Boecker OHG Germany
Lancaster Products PA
Nol-Tec Systems Inc MN
Whirl Air Flow Corp MN

Barcode Labels
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Novadis GmbH Switzerland
Rockwell Automation Inc WI
Strico AG Switzerland

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Lancaster Products PA
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Martin Engineering IL
Nol-Tec Systems Inc MN

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Bulk Pack Inc LA
Dover Conveyor Inc OH
Jenike & Johanson Inc MA
Nol-Tec Systems Inc MN
Tempo Plastic CA
Whirl Air Flow Corp MN

Blenders
Aadvanced Machinery Inc MI
Applicon Co IN
Cyclonaire Corp NE
Detroit Process Machinery MI
Dynamic Air Inc MN
Gasbarre Products (PTX Pentronix) PA See ad page 81
Glen Mills Inc NJ See ad page 87
Hosokawa Micron Powder Systems NJ
Laguna Clay Co CA
Lancaster Products PA
Littleford Day Inc KY
Mohr Corp MI See ad page 81
Netzsch Premier Technologies LLC PA
Nol-Tec Systems Inc MN
Norstone Inc PA
Sturtevant Inc MA
Sweco KY
Whirl Air Flow Corp MN
Young Industries Inc PA

Blungers
Eirich Machines Inc IL
Process Engineering Services TX

Briquetting & Tableting Equipment
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Applicon Co IN
Hosokawa Micron Powder Systems NJ

Buckets, Elevator
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Dover Conveyor Inc OH
Maxi-Lift Inc TX

Classifiers
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Haver & Boecker OHG Germany
Hosokawa Micron Powder Systems NJ
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Norstone Inc PA
Raymond Bartlett Snow IL
Russell Finex Inc NC
Sturtevant Inc MA
Sweco KY
Young Industries Inc PA

Compressors, Air
Kaeser Compressors Inc VA

Conveyors
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Cambridge Intl MD
Cambridge Wire Cloth Co MD
Carolina Material Technologies NC
Casso-Solar Technologies NY
CERIC Technologies France
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Kornylak Corp OH
Manufacturers Equipment Co OH
Martin Engineering IL
Maxi-Lift Inc TX
Nol-Tec Systems Inc MN
Rockwell Automation Inc WI
Siemens Process Industries & Drives GA
UV Process Supply Inc IL
Velco GmbH Germany
WCS Inc CA
Whirl Air Flow Corp MN
Young Industries Inc PA

Conveyors, Belt
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Cambridge Intl MD
Cambridge Wire Cloth Co MD
Carolina Material Technologies NC
Casso-Solar Technologies NY
Dover Conveyor Inc OH
GV Service Inc NY
Lanly Co OH
Martin Engineering IL
The CS Bell Co OH
UV Process Supply Inc IL

Conveyors, Bucket
Applicon Co IN
Dover Conveyor Inc OH
Maxi-Lift Inc TX

Conveyors, Pneumatic
Applicon Co IN
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Cyclonaire Corp NE
Dynamic Air Inc MN
Nol-Tec Systems Inc MN
Vector Technologies Inc WI
Velco GmbH Germany
Whirl Air Flow Corp MN

Conveyors, Screw
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Carolina Material Technologies NC
Cyclonaire Corp NE
Dover Conveyor Inc OH
Dynamic Air Inc MN

Conveyors, Vibrating
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Carman Industries Inc IN
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Cleveland Vibrator Co OH
Dynamic Air Inc MN
GV Service Inc NY
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AVEKA MN
Basic Machinery Co Inc NC
CERIC Technologies France
Detroit Process Machinery MI
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Glen Mills Inc NJ See ad page 87
Gundlach Equipment Corp IL
Hosokawa Micron Powder Systems NJ
Lancaster Products PA
Manufacturers Equipment Co OH
Mohr Corp MI See ad page 81
Retsch Inc PA
Schutte-Buffalo Hammermill LLC NY
Stedman Machine Co IN
Sturtevant Inc MA
Williams Patent Crusher & Pulverizer Co Inc MO
Wyssmont Co NJ

Crushers, Hammermill
AVEKA MN
Glen Mills Inc NJ See ad page 87
Hosokawa Micron Powder Systems NJ
Schutte-Buffalo Hammermill LLC NY
Stedman Machine Co IN
Sturtevant Inc MA
The CS Bell Co OH
Williams Patent Crusher & Pulverizer Co Inc MO
Wyssmont Co NJ

Crushers, Impact
Applicon Co IN
Glen Mills Inc NJ See ad page 87
Gundlach Equipment Corp IL
Schutte-Buffalo Hammermill LLC NY
Stedman Machine Co IN
Sturtevant Inc MA
Williams Patent Crusher & Pulverizer Co Inc MO
Wyssmont Co NJ

Crushers, Jaw
Applicon Co IN
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Glen Mills Inc NJ See ad page 87
Schutte-Buffalo Hammermill LLC NY
Sturtevant Inc MA

Crushers, Primary
CERIC Technologies France
Gundlach Equipment Corp IL
Schutte-Buffalo Hammermill LLC NY
Stedman Machine Co IN
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Crushers, Roll
Applicon Co IN
CERIC Technologies France
Gundlach Equipment Corp IL
Lancaster Products PA
Manufacturers Equipment Co OH
Sturtevant Inc MA
Williams Patent Crusher & Pulverizer Co Inc MO

Cullet-Handling Equipment
Applicon Co IN
Carman Industries Inc IN
Dover Conveyor Inc OH
Dynamic Air Inc MN
General Glass Equipment Co NJ
Whirl Air Flow Corp MN

Drum Tumblers
Glen Mills Inc NJ See ad page 87

Dryers, Fluid Bed
Applicon Co IN
AVEKA MN
Carman Industries Inc IN
Dynamic Air Inc MN
Williams Patent Crusher & Pulverizer Co Inc MO

Dryers, Rotating Tray
Raymond Bartlett Snow IL
Wyssmont Co NJ

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Dynamic Air Inc MN
Guyson Intl Ltd UK
Nilfisk-Advance America Inc MN
Nol-Tec Systems Inc MN
Spencer Turbine Co CT

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Bindicator SC
Carolina Material Technologies NC
Dynamic Air Inc MN
Guyson Intl Ltd UK
Martin Engineering IL
Nilfisk-Advance America Inc MN
Spencer Turbine Co CT
UV Process Supply Inc IL
Vector Technologies Inc WI
Whirl Air Flow Corp MN
Young Industries Inc PA

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Presto Stantest Pvt Ltd India
Tempo Plastic CA

Electric Screen Heating
Midwestern Industries Inc OH

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OPF Enterprises MT
Oxy-Gon Industries Inc NH
Rockwell Automation Inc WI
Siemens Process Industries & Drives GA
Spencer Turbine Co CT
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Carman Industries Inc IN
Carolina Material Technologies NC
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Dover Conveyor Inc OH
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Fritsch GmbH - Milling & Sizing Germany
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Manufacturers Equipment Co OH
Nol-Tec Systems Inc MN
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Applicon Co IN
Carman Industries Inc IN
Carolina Material Technologies NC
Dover Conveyor Inc OH
Merkle Intl Inc IL
Nol-Tec Systems Inc MN
Siemens Process Industries & Drives GA

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Applicon Co IN
Carolina Material Technologies NC
Dynamic Air Inc MN

Feeders, Pneumatic
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Filters
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Cambridge Wire Cloth Co MD
Croll-Reynolds Engineering Co CT
Filtros Ltd NY
Haver & Boecker OHG Germany
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Naylor Hathernware UK
Norstone Inc PA
ProChem Inc VA
Russell Finex Inc NC
Sweco KY
Tape Casting Warehouse Div PA
Texers Technical Ceramics Inc Canada
Whirl Air Flow Corp MN

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Norstone Inc PA
Tape Casting Warehouse Div PA
Vector Technologies Inc WI

Granulators
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CW Brabender Instruments Inc NJ
Fritsch GmbH - Milling & Sizing Germany
Hosokawa Micron Powder Systems NJ
Littleford Day Inc KY
Mohr Corp MI **See ad page 81**
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Wyssmont Co NJ

Grinders
Action Superabrasives OH
Buehler Ltd IL
CERIC Technologies France
Diamond Industrial Tools Inc IL
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Norstone Inc PA
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Grinding Media
CerCo LLC OH
Dunhua Zhengxing Abrasive Co Ltd China
ER Advanced Ceramics Inc OH
Federal-Mogul MI
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Glen Mills Inc NJ **See ad page 87**
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Netzsch Premier Technologies LLC PA
Norstone Inc PA
OPF Enterprises MT
Sweco KY
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CERIC Technologies France
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DeMarco Vacuum Corp IL
Dover Conveyor Inc OH
Dynamic Air Inc MN
Eirich Machines Inc IL
Gasbarre Products (PTX Pentronix) PA **See ad page 81**
Jet Edge Waterjet Systems MN
Kornylak Corp OH
Lancaster Products PA
Manufacturers Equipment Co OH
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North Star Equipment Inc WA
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Rockwell Automation Inc WI
Siemens Process Industries & Drives GA
Spencer Turbine Co CT
Sweco KY
Tempo Plastic CA
Vector Technologies Inc WI
Whirl Air Flow Corp MN
Young Industries Inc PA

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CerCo LLC OH
ER Advanced Ceramics Inc OH
Jyoti Ceramic Industries Pvt Ltd India
Norstone Inc PA
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ER Advanced Ceramics Inc OH
Euro Support Advanced Materials Netherlands
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Fritsch Milling & Sizing PA
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Hockmeyer Equipment Corp NC
Naylor Hathernware UK
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Norstone Inc PA
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Retsch Inc PA
Schutte-Buffalo Hammermill LLC NY
Sonic-Mill NM
Stedman Machine Co IN
Sturtevant Inc MA
Sweco KY
Tape Casting Warehouse Div PA
Union Process OH

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Custom Processing Services PA
Detroit Process Machinery MI
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Norstone Inc PA
OPF Enterprises MT
Sturtevant Inc MA
Union Process OH
Wyssmont Co NJ

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Aadvanced Machinery Inc MI
Advanced Ceramics Manufacturing AZ
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Glen Mills Inc NJ **See ad page 87**
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Haiku Tech Inc FL
Hosokawa Micron Powder Systems NJ
MSE Supplies AZ
Naylor Hathernware UK
Netzsch Premier Technologies LLC PA
Norstone Inc PA
Process Engineering Services TX
Raymond Bartlett Snow IL
Sweco KY
Union Process OH
Xieta Intl SL Spain

Mills, Centrifugal
Fritsch GmbH - Milling & Sizing Germany
Glen Mills Inc NJ **See ad page 87**

Mills, Hammer
AVEKA MN
Glen Mills Inc NJ **See ad page 87**
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Schutte-Buffalo Hammermill LLC NY
Stedman Machine Co IN
Sturtevant Inc MA
The CS Bell Co OH
Williams Patent Crusher & Pulverizer Co Inc MO

Mills, Jar
Detroit Process Machinery MI
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Norstone Inc PA
Tape Casting Warehouse Div PA

Mills, Jet
AVEKA MN
Fluid Energy Processing & Equipment Co PA
Hosokawa Micron Powder Systems NJ
Netzsch Premier Technologies LLC PA
Norstone Inc PA
Sturtevant Inc MA

Mills, Planetary
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
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MSE Supplies AZ
Retsch Inc PA

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Wyssmont Co NJ

Mills, Roll
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Haiku Tech Europe BV Netherlands
Haiku Tech Inc FL
Mark Hydrauliks Pvt India
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Norstone Inc PA
Raymond Bartlett Snow IL
Tape Casting Warehouse Div PA
Williams Patent Crusher & Pulverizer Co Inc MO

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Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
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Netzsch Premier Technologies LLC PA
Reed Gunite & Shotcrete Equipment CA
Rockwell Automation Inc WI
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Peter Pugger Manufacturing Inc CA
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Whirl Air Flow Corp MN

Mixers, Drum
Glen Mills Inc NJ **See ad page 87**
Hockmeyer Equipment Corp NC
Norstone Inc PA
UV Process Supply Inc IL

Mixers, Pneumatic
Carolina Material Technologies NC
Dynamic Air Inc MN
Nol-Tec Systems Inc MN
Whirl Air Flow Corp MN

Mixers, Portable
Dynamic Air Inc MN
Jiffy Mixer Co Inc CA
Peter Pugger Manufacturing Inc CA

Mixers, Refractory
Applicon Co IN
Eirich Machines Inc IL
EZ Grout Corp OH
GV Service Inc NY
Laeis GmbH Luxembourg
Lancaster Products PA
Littleford Day Inc KY
Netzsch Premier Technologies LLC PA
Peter Pugger Manufacturing Inc CA
Reed Gunite & Shotcrete Equipment CA

Mixers, Vacuum
Applicon Co IN
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Hockmeyer Equipment Corp NC
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Laguna Clay Co CA
Lancaster Products PA
Littleford Day Inc KY
Netzsch Premier Technologies LLC PA
Norstone Inc PA
OPF Enterprises MT
Peltsman Corp MN
Peter Pugger Manufacturing Inc CA
Process Engineering Services TX
Resodyn Acoustic Mixers Inc MT
Sweco KY
UV Process Supply Inc IL
Whirl Air Flow Corp MN
Young Industries Inc PA

Nozzles
CerCo LLC OH
CERIC Technologies France
Dunhua Zhengxing Abrasive Co Ltd China
HC Starck GmbH Germany
Maryland Ceramic & Steatite Co Inc MD
Renite Co OH
Tenmat Ltd UK

Packaging
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Velco GmbH Germany
Whirl Air Flow Corp MN
Young Industries Inc PA

Process Control Equipment
Bindicator SC
Control Instruments Corp NJ
Datapaq Inc NH
Eirich Machines Inc IL
General Glass Equipment Co NJ
Nol-Tec Systems Inc MN
Norcross Viscosity Controls MI
Ram Products Inc OH
Rockwell Automation Inc WI
Siemens Process Industries & Drives GA
Strainoptics Inc PA

Pulverizers
Applicon Co IN
Basic Machinery Co Inc NC
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
Glen Mills Inc NJ
Gundlach Equipment Corp IL
Hosokawa Micron Powder Systems NJ
Process Engineering Services TX
Schutte-Buffalo Hammermill LLC NY
Stedman Machine Co IN
Sturtevant Inc MA
Williams Patent Crusher & Pulverizer Co Inc MO
Wyssmont Co NJ

Pumps
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Fluid Metering Inc NY
Goulds Pumps ITT NY
GV Service Inc NY
Ram Products Inc OH
Reed Gunite & Shotcrete Equipment CA
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Pumps, Concrete
Plasma Etch Inc NV
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Pumps, Drum
UV Process Supply Inc IL

Pumps, Vacuum
CERIC Technologies France
Kaeser Compressors Inc VA

Scale Systems
CSC Force Measurement Inc MA
Mettler-Toledo Inc OH
Whirl Air Flow Corp MN

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Basic Machinery Co Inc NC
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Cambridge Wire Cloth Co MD
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Control Instruments Corp NJ
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Detroit Process Machinery MI
Emery Winslow Scale Co CT
Fluid Metering Inc NY
Fritsch GmbH - Milling & Sizing Germany
Fritsch Milling & Sizing PA
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Haver & Boecker OHG Germany
Hebei Tengfei Wire Mesh Co Ltd China
Hosokawa Micron Powder Systems NJ
Manufacturers Equipment Co OH
Midwestern Industries Inc OH
Mohr Corp MI **See ad page 81**
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Process Engineering Services TX
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Russell Finex Inc NC
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Sturtevant Inc MA
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Williams Patent Crusher & Pulverizer Co Inc MO
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Arch Maintenance Services GA
AVEKA MN
Detroit Process Machinery MI
Dorst America Inc PA
Elan Technology GA
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Spray Drying Systems Inc MD

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Whirl Air Flow Corp MN

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Vibrators, Bin
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Carolina Material Technologies NC
Cleveland Vibrator Co OH
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CSC Force Measurement Inc MA
Dynamic Air Inc MN
Eirich Machines Inc IL
Emery Winslow Scale Co CT
Hosokawa Micron Powder Systems NJ
Mettler-Toledo Inc OH
Nol-Tec Systems Inc MN
Siemens Process Industries & Drives GA

Wire Cloth
Cambridge Intl MD
Cambridge Wire Cloth Co MD
Haver & Boecker OHG Germany
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Laguna Clay Co CA
Mixer Systems Inc WI

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Krautzberger NA LLC VA
Lippert Germany
Manufacturers Equipment Co OH
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Mixer Systems Inc WI
Swindell Dressler Intl Co PA
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Laeis GmbH Luxembourg
LIXIL Corp Japan
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LIXIL Corp Japan
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Associated Ceramics & Technology Inc PA
Astral Material Industrial Co Ltd China
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Rath Inc DE
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Magneco Metrel Inc IL
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Refractory Specialties Inc OH
RHI US Ltd NY
Zhengzhou Sunrise Refractory Co Ltd China

Backwalls
Fosbel Inc OH
Merkle Intl Inc IL
Zhengzhou Sunrise Refractory Co Ltd China

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Ciria India Ltd India
Furnace Products & Services Inc PA
Luoyang Yilong Refractory Co Ltd China
Magneco Metrel Inc IL
Missouri Refractories Co (MORCO) MO
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Togni SA Materiais Refractarios Brazil
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Avkem Intl TN
Ceramaterials NY
Cetek Ltd OH
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Ceramaterials NY
Ciria India Ltd India
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General Material Industrial Co China
HarbisonWalker Intl PA
Insulating Firebrick Inc PA
Lam Dong Minerals & Building Materials Joint-Stock Co Vietnam
Luoyang Yilong Refractory Co Ltd China
Morgan Thermal Ceramics GA
Pacific Refractories Ltd India
Prairie Ceramics Corp CA
RHI US Ltd NY
Saint-Gobain Ceramic Materials MA
Shinagawa Advanced Materials American Inc OH
Sunrock Ceramics Co IL
Togni SA Materiais Refractarios Brazil
Whitacre Greer Co OH
Wistra France
Wistra GmbH Germany

Brick, Acid-Resisting
Dynamic Exim Corp India
Khodiyar Ceramics (India) Pvt Ltd India
Koch Knight LLC OH
Luoyang Yilong Refractory Co Ltd China
Pacific Refractories Ltd India
Togni SA Materiais Refractarios Brazil
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Alsey Refractories Co MO
B&B Refractories Inc CA
Burton GmbH & Co KG Germany
Ceramaterials NY
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Ciria India Ltd India
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Pryor Giggey Co AL
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Vitcas Ltd UK
Whitacre Greer Co OH
Yangquan Metals & Minerals Import & Export Co Ltd China
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Astral Material Industrial Co Ltd China
Ceramaterials NY
Koch Knight LLC OH
Pacific Refractories Ltd India
Shinagawa Advanced Materials American Inc OH

Castable
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Alsey Refractories Co MO
Aremco Products Inc NY
Capital Refractories Ltd UK
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Zircar Zirconia Inc NY

Clay Flux

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Peter Pugger Manufacturing Inc CA
RHI US Ltd NY

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Aremco Products Inc NY
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Rath Inc DE
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Riverside Refractories Inc AL
Saint-Gobain Ceramic Materials MA
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Thermal Products Co Inc GA
Unifrax I LLC NY **See ad page 93**
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Zibo Guangtong Chemical Co Ltd China
Zircar Refractory Composites Inc NY
ZYP Coatings Inc TN

Cordierite

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Advanced Ceramic Technology CA
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Prairie Ceramics Corp CA
Rauschert Industries Inc TN
Refratarios Paulista Industria e Comercio Ltda Brazil
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Smaht Ceramics Inc UT
Usen Material Industrial Co Ltd China

Crucibles

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LECO Corp MI
Magneco Metrel Inc IL
McDanel Advanced Ceramic Technologies LLC PA
Prairie Ceramics Corp CA
Progressive Technology Inc CA
Pryor Giggey Co AL
Selee Corp NC
Silicon Carbide Products Inc NY
Triangle Ceramics NC
Usen Material Industrial Co Ltd China
Zhengzhou Mission Ceramic Products Co Ltd China
Zhengzhou Peakland Industrial Co Ltd China
Zircoa Inc OH

Dead-Burned

Fluid Energy Processing & Equipment Co PA
Togni SA Materiais Refractarios Brazil

Fiber Products

Allied Mineral Products Inc OH
Ceramaterials NY
Cetek Ltd OH
Ciria India Ltd India
Cotronics Corp NY
Fame Rise Refractories Co Ltd China
Firebird Thermal Products Co China
Furnace Products & Services Inc PA
LECO Corp MI
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Ipsen Ceramics IL
LECO Corp MI
Magneco Metrel Inc IL
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Mixer Systems Inc WI
Pryor Giggey Co AL
Riverside Refractories Inc AL
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Silicon Carbide Products Inc NY
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Zircar Refractory Composites Inc NY

Fused Cast

Enterprise Personnel CO
Fosbel Inc OH
Furnace Products & Services Inc PA
Mixer Systems Inc WI
Phoenix Coating Resources Inc FL
Saint-Gobain Ceramic NY **See ad page 53**
Zhengzhou Sunrise Refractory Co Ltd China

Fused Spinel

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Zhengzhou Sunrise Refractory Co Ltd China

Glass Furnace

Deltech Inc CO **See ad page 70**
Filtros Ltd NY
Fosbel Inc OH
Furnace Products & Services Inc PA
HarbisonWalker Intl PA
Ipsen Ceramics IL
Magneco Metrel Inc IL
Mixer Systems Inc WI
OCL India Ltd India
RHI US Ltd NY
Togni SA Materiais Refractarios Brazil
Vesuvius SC
Zhengzhou Peakland Industrial Co Ltd China

Graphite

Ceramaterials NY
Furnace Products & Services Inc PA
Renite Co OH
Shinagawa Advanced Materials American Inc OH
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Grog

Alsey Refractories Co MO
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Gunning
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Ciria India Ltd India
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OCL India Ltd India
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Pryor Giggey Co AL
Reno Refractories Inc AL
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Togni SA Materiais Refractarios Brazil
Unifrax I LLC NY **See ad page 93**
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High-Alumina
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Blasch Precision Ceramics Inc NY
Bucher Emhart Glass SA Switzerland **See ad page 94**
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Xieta Intl SL Spain
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Zhengzhou Mission Ceramic Products Co Ltd China
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Insulation
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Ceramaterials NY
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Zhengzhou Peakland Industrial Co Ltd China
Zhengzhou Sunrise Refractory Co Ltd China
Zircar Ceramics Inc NY
Zircar Refractory Composites Inc NY
Zircar Zirconia Inc NY

Insulation Slabs, Calcium Silicate
Ceramaterials NY
Furnace Products & Services Inc PA
Promat GmbH Germany
Refractory Specialties Inc OH
Usen Material Industrial Co Ltd China
Zircar Refractory Composites Inc NY

Insulation Slabs, Vermiculite
Insulating Firebrick Inc PA
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Usen Material Industrial Co Ltd China
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Burton GmbH & Co KG Germany
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Promat GmbH Germany
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Simond Intl LLC TX
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Usen Material Industrial Co Ltd China
Zhengzhou Peakland Industrial Co Ltd China
Zircar Ceramics Inc NY

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American Art Clay Co Inc IN
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Manufactures pressed, cast, and extruded shapes (in alumina to zironia) for kiln furniture; refractory shapes for ultrahigh temperatures; and ceramic honeycomb. Markets include electronic components, powder metal, crystal growth, and catalyst supports.

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AACCM's member companies manufacture components from ceramic powders at U.S. operating facilities. Its purpose is to expand the market for U.S. manufactured components by enhancing processes and quality and to increase awareness of ceramic applications.

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CelSian Glass & Solar BV provides industrial contract research, technological solutions, and consultancy to the global glass and solar market. Assists companies in optimization of glass and silicon production and innovation of related products.

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Manufacturer and supplier of industrial heat-treatment furnaces with Japanese technology, including batch-type integral sealed quench and soft nitriding furnaces, mesh belt furnaces, decarb annealing and blueing, and controlled-atmosphere brazing.

DRAYTON BEAUMONT KILNS LTD +44-1782-6573
Walley St Burslem Fax: +44-1782-658946
Stoke-on-Trent Staffordshire UK ST6 2AH

info@beaumontkilns.co.uk
http://beaumontkilns.co.uk

Established 1965. Exports worldwide. Designs, installs, commissions, and modifies rapid-fire, wide-load, continuous kilns, and low-thermal-mass intermittents for bone china porcelain, tableware, and sanitaryware as well as shuttle, moving-hood, and more.

DU-CO CERAMICS CO 724-352-1511
155 S Rebecca St Fax: 724-352-1266
PO Box 568
Saxonburg PA US 16056

sales@du-co.com
http://du-co.com

Dry-pressed, roll compaction, and extruded forms in steatite, cordierite, MgO, forsterite, porcelain, mullite, and alumina. High purity materials are also available in MgO and alumina. Secondary operations include machining, glazing, grinding, and tumbling. Facilities: Saxonburg, Pa., (main) and Monroe, N.C.

DUNHUA ZHENGXING ABRASIVE CO LTD +86-433-6340878
No 4 Industry Rd Fax: +86-433-6340868
Development Zone
Dunhua Jilin China 133700

rula@boroncarbide.cn
http://boroncarbide.cn

Manufacturer of boron carbide since 1987. ISO 9001 and ISO 14001 certified. Major products: boron carbide powder, boron carbide sand nozzle, boron carbide plate, and boron carbide neutron-absorbing material.

DUPONT ELECTRONIC TECHNOLOGIES 919-248-5304
14 TW Alexander Dr Fax: 919-248-5770
Research Triangle Park NC US 27709-3999

contactmcm@usa.dupont.com
http://mcm.dupont.com

Diversified supplier of polymer and ceramic thick-film technologies for hybrid circuits, modules, military radar and avionics, biosensors, solar cells, rear-window defoggers, membrane touch switch panels, chip capacitors and resistors, etc.

DYNACUT INC 610-346-7386
3425 Funk Mill Rd Fax: 610-346-6770
Springtown PA US 18081

rplatt@dynacut.com
http://dynacut.com

Established 1965. Manufactures precision cutoff machines for glass, ceramics, metallurgical, composite, and geological applications. Designs and manufactures custom production cutting and grinding machinery.

DYNAMIC AIR INC 651-484-2900
1125 Willow Lake Blvd Fax: 651-484-7015
St Paul MN US 55110

info@dynamicair.com
http://dynamicair.com

Manufactures complete line of dense-phase and dilute-phase pneumatic conveying systems and components for handling a wide variety of dry bulk granular materials. Systems include rail and truck unloading, bulk-bag unloading, weighing, and batching.

DYNAMIC EXIM CORP 91-288-2675560
241-242 Indraprasth Fax: 91-288-2556844
Pancheshwar Tower Rd
Jamnagar Gujarat India 361001

info@calciumaluminatecements.com
http://www.calciumaluminatecements.com

Dynamic supplies calcium aluminate cements, high-alumina cements, and high-alumina refractory cements from India. It also supplies high-quality refractory fire bricks, including fireclay bricks, high-alumina bricks, mortars, and castables.

DYNASIL FUSED SILICA 856-767-4600
385 Cooper Rd Fax: 856-767-6813
West Berlin NJ US 08091-9145

sales@dynasilfusedsilica.com
http://dynasilfusedsilica.com

Established in 1960. Supplies ultra-high-purity synthetic fused silica for laser, optical, electronic, and military applications. Fabricates unpolished and commercially polished glass blanks for these markets. Excimer-grade material is also available.

EBL PRODUCTS INC 860-291-2537
91 Prestige Park Cir Fax: 860-291-2533
East Hartford CT US 06108

eblpzt.paul@sbcglobal.net
http://eblproducts.com

Provides standard, application-specific, and industrial piezoceramic transducer elements to researchers as well as manufacturers of piezoelectric transducers according to their terms and specifications.

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sales@edoceramic.com
http://edoceramic.com

Provides piezoelectric materials, compositions, shapes, assemblies, and sensors for the commercial, sonar, ultrasonic, medical, aerospace, automotive, and military markets.

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info@ortonceramic.com
http://ortonceramic.com

The Edward Orton Jr. Ceramic Foundation manufactures and markets pyrometric cones, TempCHEks, Temp Tabs, electronic temperature controllers, thermoanalytical instruments, and provides materials-testing services.

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eirichusa@eirichusa.com
http://www.eirichusa.com

Eirich Machines designs, manufactures, and supplies batch & continuous mixers and systems. Its complete product line for mixing, pelletizing, grinding, granulating, and plasticizing, in sizes ranging from 1 to 12,000 liters, also can be equipped with vacuum.

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Midway GA US 31320

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Elan Technology has been developing and manufacturing advanced ceramics and glass materials for more than 70 years. Its expert team of engineers can offer custom compositions to fit the most demanding applications.

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http://www.eleceramic.en.ecplaza.net

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Buffalo NY US 14218

info@electroabrasives.com
http://electroabrasives.com

Manufactures black SiC, green SiC, and boron carbide. Also makes SiC grains and water-classified fine powders to ANSI and FEPA F sizes, submicron, as well as refractory and custom splits. Applications include ceramics, abrasives, and refractories.

ELEKTRO PHYSIK 847-437-6616
770 W Algonquin Rd Fax: 847-437-0053
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epusa@elektrophysik.com
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Designs and manufactures compacting tooling for rotary and single-station presses at three U.S. sites. Subsidiary E-S&K manufactures spare parts and turrets and provides rebuild services for presses. E-H sells and services the Hata rotary press.

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siliconinfo@elkem.com
http://www.silicon.elkem.com

Elkem products that may be of interest in the advanced ceramics field are the Silgrain line of silicon powders. Silicon powder often is used as a raw material for manufacturing silicon nitride and silicon carbide ceramics.

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hauck@hauckburner.com

Manufactures and distributes combustion equipment and systems for heat-processing applications. Product line includes burners, blowers, pulse-firing, and other furnace and kiln process control systems as well as gas-measuring and metering equipment.

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homeoffice@emerywinslow.com
http://emerywinslow.com

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New Castle DE US 19720

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Manufactures and sells QPAC poly (alkylene carbonate) binders worldwide. QPAC features excellent green strength and processability and extremely clean burnout in a variety of atmospheres. Available in solids, solutions, and water-based emulsions.

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kconsidine@engis.com
http://www.engis.com

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Produces a catalog of inspection instruments for industry. Products include IR thermometers with laser sighting, ultrasonic thickness gauges, leak detectors, sound level meters, and multimeters.

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info@ezgrout.com
http://ezgrout.com

Manufactures masonry and concrete equipment. Product line includes the Grout Hog, Mud Hog Mixer, Booger Hog, and Hog Leg, all registered trademarks of the company.

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Gewerbepark 11 Fax: +49-36766-868-68
Rauenstein Thuringia Germany D-96528

info@fcti.de
http://fct-keramik.de

Produces customized components made of silicon nitride-based ceramics, sintered silicon carbide, C/C-SiC composites, and zirconia. Major applications are in light-metal casting, wear protection, electronics, precision optics, testing equipment, metal forming, and brake pads.

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Hoenbacher Str 5 Fax: +49-3675-427-5-15
Sonneberg Thuringia Germany D-96515

hartbearbeitung@fct-keramik.de
http://fct-keramik.de

Produces ceramic components, from small, highly precise parts to large-sized, complex-shaped parts, made of zirconium oxide (Y-TZP), sintered silicon carbide, and silicon nitride. Offers hard-machining on per-job basis.

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Gewerbepark 16 Fax: +49-36766-824-150
Frankenblick Thuringia Germany D-96528

info@fct-systeme.de
http://www.fct-systeme.de

Develops and manufactures sintering systems, such as hot presses and systems for spark plasma sintering, gas-pressure sintering, and vacuum sintering up to ultrahigh temperatures for engineering ceramics, powder metallurgy, photovoltaics, and more.

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47001 Port St Fax: 734-254-8905
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bill.walker@federalmogul.com
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http://ferroceramic.com

Established 1966. Advance ceramic component supplier and manufacturer specializing in precision machining. Materials include BN, Macor, alumina, SiC, sapphire, zirconia, quartz, ferrites, and related materials. Also provides CAD/CAM CNC machining.

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Binjiang District
Hangzhou Zhejiang China 310053

lutt@ferrotec.com.cn
http://ceramics.ferrotec.com/ceramics-home

Japanese company with manufacturing location in China. Ceramics and quartz division has become the largest manufacturer of semiconductor components in China since 2007.

FILTROS LTD 585-586-8770
PO Box 389 Fax: 585-586-7154
East Rochester NY US 14445

ggoeller@filtrosltd.com
http://filtrosltd.com

Established in 1913. Manufactures porous ceramics and refractory materials and products. Forming processes used are pressing, extruding, casting, injection molding, jolting, finish machining, and crushing.

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Zhengzhou Henan China 450002

firebirdcorp@yahoo.cn
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Firebird Thermal Products is founded on the principle of quality, value, and service. Applies itself to meet customers' various demands on high-temperature materials, including refractories, ceramics, and industry raw materials.

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Manufactures metering pumps and dispensers with valveless, positive-displacement design. Features ceramic/fluorocarbon fluid path, low dead volume, and flows from 0 to 4,600 mL/min to 100 psig.

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info@isc.fraunhofer.de
http://www.isc.fraunhofer.de

Institute for applied research in the field of nonmetallic inorganic materials. Main research divisions are glass, ceramics, and inorganic–organic hybrid polymers.

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Independent representative organization providing insulating firebrick, machining services, furnace rebuilds, combustion systems, forehearths, etc.

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http://www.thefurnacesource.com

The Furnace Source is a manufacturer and reseller of vacuum furnaces, sintering furnaces, vertical bell furnaces, and much more.

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dshamp8@aol.com
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Performs ceramic welding and refractory services, including hot and cold repairs. The ceramic welding process was developed and originally designed for in-situ repair of glass furnaces.

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Manufactures standard and specialty frits used in ceramic whitewares. Sells Reimbold & Strick glaze stains and specialty frits. Sells FC kaolin clay and FC kaolin slurry to the ceramic trades, especially the sanitaryware industry.

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Futura Ceramics was established in 2004 as a manufacturer of ceramic glaze frit and mixture with the intention of providing quality materials to ceramic tile industries.

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Established 1936. Manufactures refractory specialties for ceramics, heat-treating, foundry, and investment-casting industries. Diverse product line includes pottery pins, gating components, pouring cups, and filters for molten metals.

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Produces a wide variety of standard and custom refractory shapes and toll firing services. Typical ceramic shapes include plates, saggers, crucibles, and kiln furniture. Formulas include high-percentage alumina and fused silica. Toll firing services.

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http://www.lignotech.com

Produces lignosulfonate-derived organic binders, densifiers, and dispersants for use in manufacture of refractories, structural clay products, whitewares, technical, and other ceramics. Worldwide manufacturing, sales, and technical support.

LINN HIGH THERM GMBH +49-9665-91400
Heinrich Hertz Platz 1 Fax: +49-9665-1720
Eschenfelden Bavaria Germany 92275

info@linn.de
http://www.linn.de

Manufactures electrically heated industrial and lab furnaces, hf/rf mf generators, sample preparation systems for spectroscopy, microwave furnaces and dryers, and precision fine casting machines for jewelry, aerospace, automotive, and dental industries.

LINSEIS INC 609-223-2070
109 N Gold Dr Fax: 609-223-2074
Robbinsville NJ US 08691

info@linseis.com
http://www.linseis.com

Manufactures thermal analysis instruments (DSC, TMA, DTA, TG, STA), dilatometers, thermal conductivity, and thermal diffusivity systems.

LIPPERT +49-9644 67-0
Boettgerstr 46 Fax: +49-9644-8119
Pressath Bavaria Germany 92690

lippert@lippert.de
http://www.lippert.de

Lippert manufactures jolleying and jiggering plants, pressure casting machines for cups, casting plants, glazing plants, foot and rim polishing machines, finishing machines, stamping machines, dryers, plaster blending machines, and handling systems.

LITHOZ GMBH +43-1-9346612200
Mollardgasse 85a/2/64-69
Vienna 1060 Austria

mhoma@lithoz.com
http://www.lithoz.com

Lithoz is a system provider for additive manufacturing of ceramics, covering the whole process chain, including development of the machine, material, and application. Lithoz has developed LCM-technology—a slurry-based additive manufacturing method based on photo-polymerisation with high resolution and good reproducibility—that can process most sinterable powders.

LIQTECH NA INC 651-773-5850
1804 Buerkle Rd Fax: 651-773-5866
White Bear Lake MN US 55110-5245

debelakd@liqtechna.com
http://liqtechna.com

Manufactures recrystallized silicon carbide products, including kiln furniture, diesel particulate filters, and ceramic filters with membranes for liquid filter applications.

LITTLEFORD DAY INC 800-365-8555
7451 Empire Dr Fax: 859-525-1446
Florence KY US 41042

sales@littleford.com
http://littleford.com

Manufactures processing equipment, including mixers, granulators, agglomerators, vacuum dryers, liquid dispersers, and pressure reactors. Also provides pilot-plant and lab equipment. Maintains a completely equipped test center to assist customers.

LIXIL CORP
3-77 Minatocyo
Tokoname Aichi Japan 479-8588

global-site@lixil.co.jp
http://global.lixil.co.jp

Established in 1924. Manufactures all types of tile, bathroom fittings and fixtures, sanitaryware, plastic bathtubs, prefabricated bathrooms, and vanity cabinets.

LOCK 3 CO 724-258-7773
1469 Delberts Dr Fax: 724-258-8171
Monongahela PA US 15063

cmuse@l3company.com
http://l3company.com

Offers minerals for refractories manufacture. Also crushes, blends, screens, and packages materials for third-party refractory companies.

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Behringstr 19a Fax: +49-6021-7900-50
Mainaschaff Bavaria Germany D-63814

info@logomatic.de
http://logomatic.de

Grinding machines for semiconductor and solar industries. Diamond wire saws and polish grinding machines. PV seed, mono- and multicrystalline ingot cutting diamond wire saws (3-in-1). PV wafer production lines. Wire guide regrooving service for HCT.

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65 Walnut St Fax: 419-929-1552
New London OH US 44851

info@londontile.com
http://www.londontile.com

Manufactures ceramic floor, wall, and countertop tile. Also performs custom work.

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Penkhull
Stoke-on-Trent Staffordshire UK ST4 7LQ

enquiries@lucideon.com
http://www.lucideon.com

Lucideon, formerly Ceram, is a leading international provider of materials development, testing, and assurance.

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2048 Bunnell Rd Fax: 215-343-7388
Warrington PA US 18976

info@luciferfurnaces.com
http://www.luciferfurnaces.com

Manufacturer of industrial heat-processing furnaces, ovens, and kilns available in batch or continuous models with operation to 1,700°C. Economical, energy-efficient electric and gas-fired models with protective atmospheres available. Sales worldwide.

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Zhengzhou Henan China 450000

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http://www.yilongrefractory.com

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mmclays@alltell.net

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A specialty refractory manufacturer supplying products and services for the smallest ceramic shapes to linings for the world's largest blast furnace. Product lines include colloidal silica sol-gel-bonded castables, pumpables, and shotcretes.

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Malyn Industrial Ceramics Inc supplies distributors and original equipment manufacturers with quality and durable nozzles and inserts for a variety of applications. For more than 30 years, Malyn has supplied customers with the custom nozzles and parts they need—from boron carbon nozzles to tungsten carbide nozzles and inserts.

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35 Enterprise Fax: 513-424-3576
Middletown OH US 45044-8924

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Manufacture brick-cutting, coil, autosetting machine and texturing as well as hard chrome-plated die wires. GESG division is the brick industry's distributor for AccuRate feeders. Hanco controls, Burton refractories. De Boer automated soft-mud systems.

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http://www.kitkatfuse.com

Established in 1989, Maruti Refractories is a manufacturer, supplier, and exporter of electrical porcelain, Kit Kat fuse, and Cutout fuse.

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2322-3 Kakinohirohata Fax: +81-5725-22446
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http://marylandceramic.com

Etablished 1926. Produces industrial and technical ceramics. A large extrusion and dry-pretty business. Product line includes steatite, cordierite, lava, plastics, and tape casting.

MARYLAND REFRACTORIES CO 800-228-4672
Salisbury Rd Fax: 330-532-3224
Irondale OH US 43932

ccarlson@mrcgrog.com
http://mrcgrog.com

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info@metoxit.com
http://metoxit.com

Established 1978. Offers ceramic components for structural parts; wear-resistant, chemical, and high-temp applications; and filters. Pioneer in orthopedic and dental applications. Bioceramics include alumina and zirconia, both FDA approved.

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http://www.microlap.com

Microlap is a custom manufacturer specializing in small, high-precision components made from extremely hard materials, such as synthetic ruby/sapphire, zirconia and alumina ceramics, silicon nitride, tungsten carbide, stainless steel, and a few other hard materials. Its forte is the ability to produce very small parts with extremely tight tolerances from these various hard materials.

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http://microanalytical.com

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jay_s@microtrac.com
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info@midwesternind.com
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Morco is an engineering and manufacturing company producing refractory specialties based on alumina, aluminosilicate, magnesia, spinel, zircon, silicon carbide, and fused silica. The company produces a full line of unshaped products.

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Law firm specializing in the drafting and prosecution of patent applications, particularly relating to ceramics, in the U.S. and internationally. Patent attorney Bob Sayre is a member-at-large of the New England Section of ACerS.

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Performs research, development, materials analysis, testing, and manufacturing of electronic materials and components, including multilayer ceramic capacitors, sensors, customized dielectrics, and electrode compositions.

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Established 1944. Manufactures integrated electronic components. Main products include MLCC, piezoelectric components, microwave devices, and module products. Conducts R&D in a broad spectrum of functional ceramics and their potential applications.

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Valley View OH US 44125-4249

info@nanofilmtechnology.com
http://www.nanofilmtechnology.com

Nanofilm UltraSEAL coatings for glass and ceramic provide a water- and grease-repellent surface with higher abrasion resistance than untreated surfaces. Treated surface is easier to clean. Coatings are easy to apply and cure quickly at room temperature.

NANOMATERIALS AND NANOTECHNOLOGY RESEARCH CENTER (CINN) +34-985733644
Avda de la Vega 4-6
El Entrego Spain 33940

cinn_contact@cinn.es
http://www.cinn.es

The Nanomaterials and Nanotechnology Research Center, established in 2007, combines high-quality, competitive, interdisciplinary research with scientific demonstrations. CINN also aids the creation of new technology-based companies.

NANOSCIENCE INSTRUMENTS 480-758-5400
9831 S 51st C119 Fax: 480-758-5401
Phoenix AZ US 85044

info@nanoscience.com
http://www.nanoscience.com

Nanoscience Instruments sells and supports laboratory instrumentation for microscopy and surface science applications. Its team of scientists and engineers have backgrounds in chemistry, biochemistry, material science, physics, and engineering. Its portfolio includes desktop electron microscopes, atomic force microscopes, optical profilers, mechanical testing systems, nanoindenters, and correlative microscopy systems.

NATIONAL BORAXX CORP 800-292-8680
3690 Orange Pl Ste 480 Fax: 216-464-8619
Cleveland OH US 44122

msennett@seaforthinc.com
http://nationalboraxx.com

Established 1987. Distributes numerous boron products in North America through a network of warehouses that have the ability to supply product within 24 hours. Multiple applications include flame retardancy, fiberglass, insulation, and lubricants.

NATIONAL INST OF CERAMIC ENGINEERS 614-794-5821
600 N Cleveland Ave Ste 210 Fax: 614-794-5881
Westerville OH US 43082

customerservice@ceramics.org
http://ceramics.org

NICE's mission is to coordinate the accreditation of ceramics, glass, and (with TMS) materials programs through ABET, ethical principles, and the Order of the Engineer and the practice and education of ceramics.

NATIONAL LIME & STONE CO 419-422-4341
PO Box 120 Fax: 419-422-3952
Findlay OH US 45839-0120

jwells@natlime.com

Produces dried dolomitic limestone for glass manufacturing, steel manufacturing, and other industrial mineral applications. Eight commercial stone plants in Ohio.

NATIONAL MAGNETICS GROUP INC 610-867-7600
1210 Win Dr Fax: 610-867-0200
Bethlehem PA US 18017-7061

sales@magneticsgroup.com
http://magneticsgroup.com

Manufactures magnetic and advanced materials, including soft ferrites, ceramic magnets, powdered-iron products, microwave ferrites, dielectric resonators, and thermal deposition products. Subsidiary: TCI Ceramics Inc.

NAVAL SURFACE WARFARE CENTER (CARDEROCK DIV) 301-227-4501
9500 MacArthur Blvd
West Bethesda MD US 20817-5700

curtis.a.martin@navy.mil
http://www.navsea.navy.mil/nswc/carderock/default.aspx

R&D of ceramics, refractory metals, ablators, and carbon/carbon composites for weapons systems applications, including rocket nozzles, leading edges, radomes, launchers, armor, seals, and bearings.

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Clough Green Fax: +44-1226-790531
Cawthorne
Barnsley South Yorkshire UK S75 4AD

info@naylor.co.uk
http://naylor.co.uk

Supplies and manufactures industrial ceramics, including fully acid- and alkali-resistant chemical stoneware and porcelain.

NEOPTIX +1-418-687-2500
1415 Boul Charest Ouest Ste 220 Fax: +1-418-687-2524
Quebec Quebec Canada G1N 4N7

mdore@neoptix.com
http://neoptix.com

Designs and manufactures fiber-optic temperature sensors for temperature monitoring under microwaves and rf. Made of dielectric materials, temperature sensors are immune to radiation and other interferences.

NETZSCH INSTRUMENTS NA LLC 781-272-5353
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nib-sales@netzsch.com
http://www.netzsch-thermal-analysis.com

Thermal analysis and thermal properties measurement instruments, plus contract testing services; DSC; DTA; DSC-TGA; DTA-TGA; coupling for FTIR and MS dilatometers; laser flash thermal diffusiving; thermal conductivity; and more.

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info.npt@netzsch.com
http://www.netzsch-grinding.com

Provides proven nanotechnology solutions for a broad range of industries. Manufactures grinding and dispersing machinery for media milling, powder processing, dispersing, de-aerating, and filling. Comprehensive global resources in engineering and R&D.

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Novosibirsk Russia 630049

international@nevz.ru
http://www.nevz.ru

Nevz-Ceramics is one of the leading manufacturers of technical advanced ceramics in Russia. The product range includes armor ceramics, ceramic substrates, and bioceramics from alumina, steatite, forsteritite, and nitride ceramics.

NEW GLASS FORUM +81-36279-260
Japan Glass Ind Center Fax: +81-33595-255
3-21-16 Hyakunin-cho Shinjyuku-ku
Tokyo Japan 169-0073

info@ngf.or.jp
http://ngf.or.jp

Nonprofit organization (private sector) under the jurisdiction of the Japanese government established to help create high-tech glass products and applications to user industries through activities, including R&D, technical surveys, and seminars.

NEW TECH CERAMICS INC 515-868-0055
1923 Industrial Park Rd Rm A Fax: 515-864-0034
PO Box 387
Boone IA US 50036

sales@newtechceramics.com
http://www.newtechceramics.com

Supplier of $AlMgB_{14}$+. Processing service for powders, thin films, thick films, and sintered solids. All materials have extreme high hardness and low coefficient of friction and are thermally insulating and electrically conductive.

NEXCERIS LLC 614-842-6606
404 Enterprise Dr Fax: 614-842-6607
Lewis Center OH US 43035

info@nexceris.com
http://www.nexceris.com

Nexceris LLC provides product and process solutions to the energy and environmental markets, including materials, catalysts, sensors, and solid oxide fuel cells.

NGIMAT LLC +81-36279-260
2436 Over Dr Fax: +81-33595-255
Lexington KY US 40511

http://www.ngimatllc.com

nGimat brings together innovative materials science, talented and motivated employees, and strategic collaborators and customers to develop cost-effective and profitable nanopowder and thin-film materials to address critical problems faced by the world.

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2808 Iwasaki Fax: +81-568-76-1295
Komaki Aichi Japan 485-8510

info@mg.ngkntk.co.jp
http://www.ngkntk.co.jp

Manufactures and sells spark plugs and related products for internal-combustion engines. Also manufactures advanced ceramics and applicable products.

NILFISK-ADVANCE AMERICA INC 800-989-2235
9435 Winnetka Ave N Fax: 800-989-6566
Brooklyn Park MN US 55445

info@advance-us.com
http://pa.nilfisk.advance.com

Established 1960. Sales subsidiary of parent company that manufactures heavy-duty portable industrial vacuum cleaners and high-filtration portable dust collectors and toxic material collectors. Specializes in fine and abrasive powder applications.

NIOKEM INC 828-926-0199
237 Handsome Dr Fax: 610-647-6427
Waynesville NC US 28785

ernie.kapanke@niokem.com
http://www.niokem.com

Niokem is a chemical and mineral distribution company located in western North Carolina. Established in 2011, its range of products and services are expanding to meet customer needs.

NOAH TECHNOLOGIES CORP 210-691-2000
1 Noah Park Fax: 210-691-2600
San Antonio TX US 78249

sales@noahtech.com
http://noahtech.com

Manufactures ceramic powders, components, and precursors. Metal salts and oxides are augmented with expanding organic and inorganic sol-gel products. Products manufactured in San Antonio, Texas, and Monterrey, Mexico. Export and import capabilities.

NOL-TEC SYSTEMS INC 651-780-8600
425 Apollo Dr
Lino Lakes MN US 55014

sales@nol-tec.com
http://nol-tec.com

Worldwide single-source supplier of high-quality, custom-engineered pneumatic conveying, bulk material handling and integrated process control systems. Expertise includes dense- and dilute-phase (pressure or vacuum) pneumatic conveying and weighing.

NORCROSS VISCOSITY CONTROLS 617-969-7020
12427 W 1st St Fax: 617-969-3260
Washington MI US 48095

sales@viscosity.com
http://viscosity.com

Manufactures process viscosity control equipment and viscosity monitors for use on ceramic slurries and other suspensions.

NORECS AS +47-22-95-86-23
Oslo Science Park Fax: +47-22-60-44-27
Gaustadalleen 21
Oslo Norway 349

post@norecs.com
http://norecs.com

Manufactures high-temperature sample holder systems for electrical and other characterization at high temperatures, used in SOFC research and testing of ceramic membranes.

NORSTONE INC 484-684-6986
315 E 4th St Fax: 610-275-2404
Rear Bridgeport PA US 19405

sales@norstoneinc.com
http://norstoneinc.com

Manufacturer of the abrasion-resistant long-lasting Polyblade and Turbo Polyblade as well as other abrasion-resistant linings and parts from various polymers, ceramics, and spray coatings. Also provides a wide variety of metal blades.

NORTH STAR EQUIPMENT INC 509-235-9200
1341 W 1st St Fax: 509-235-9203
Cheney WA US 99004

info@northstarequipment.com
http://www.northstarequipment.com

North Star manufactures American-made slab rollers and extruders that work. Line of quality equipment also includes throwing bats, ware carts, drying racks, custom pugmill and extruder dies, and studio worktables.

NORTH STAR IMAGING INC 763-463-5650
19875 S Diamond Lane Rd Ste 10 Fax: 651-645-7568
Rogers MN US 55394

sbonnema@4ndtnsi.com
http://4nsi.com

Manufactures industrial nondestructive test systems. Specialists in industrial X-ray imaging systems, including computed tomography, microfocus X-ray imaging, automatic defect analysis, and digital X-ray imaging systems.

NORTHERN AIR CORP 800-772-4394
450 Richmond St Fax: 508-823-4949
Raynham MA US 02767

bill@pollutionfighter.com
http://www.pollutionfighter.com

Air cleaners for the industry where indoor air pollution has been an uncontrollable health and safety issue.

NORTHROP GRUMMAN CORP 410-765-1357
2980 Fairview Park Dr Fax: 410-981-4742
Falls Church VA US 22042

www.northropgrunman.com

Provides R&D of ceramic materials and processes, including ceramic packaging, dielectrics, high-energy capacitors, integrated modules, electrooptic materials, ferrites, ferroelectrics, and piezoelectrics. Tapes, bulk materials, coatings, and thin films are also available.

NOVABONE PRODUCTS LLC 904-807-0140
1551 Atlantic Blvd Ste 105 Fax: 904-807-0141
Jacksonville FL US 32207

information@novabone.com
http://www.novabone.com

Focused on developing bone grafting materials based on advancements in biomedical engineering to meet surgeons' needs. Products have been used in more than a million patients with success, demonstrating the safety and efficiency of patented technology.

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Eichtalstr 55 Fax: +41-44-810-04-91
Hombrechtikon Zurich Switzerland 8634

info@novadis.ch
http://www.novadis.ch

Manufacturer and exporter of kiln-proof sanitary ceramic barcode labels and RFID tags and transponders.

NOVOMER INC 781-314-9179
1601 Trapelo Rd Ste 152 Fax: 781-672-2525
Waltham MA US 02451

info@novomer.com
http://novomer.com

Novomer is a new materials company pioneering a family of competitively priced high-performance green plastics, polymers, and other chemicals.

NSL ANALYTICAL SERVICES INC 216-438-5200
4450 Cranwood Pkwy Fax: 216-438-5050
Cleveland OH US 44128

nsl@nslanalytical.com
http://www.nslanalytical.com

Commercial testing lab specializing in elemental chemistry, metallurgy, and polymer analysis. Certifications include ISO/IEC 17025 and NADCAP. Techniques include trace elemental analysis using ICP/MS and dc arc, classical wet chemistry, and ICP-OES.

NUTEC BICKLEY 855-299-9566
Mirador de las Mitras
NL Mexico 66359

sales@nutec.com
http://www.nutecbickley.com

Nutec Bickley designs and manufactures kilns to fire ceramics attending the following industries: sanitaryware, technical ceramics, electroporcelain insulators, refractories, heavy clay, and special applications.

NV BEKAERT SA +32-56-23-5-11
President Kennedypark 18 Fax: +32-56-23-5-43
Kortrijk West Flanders Belgium 8-8500

info@bekaert.com
http://bekaert.com

Offers sputter solutions and technology for such applications as architectural and automotive glass (including low-E and solar control films and anti-reflective coatings), display glass, and photovoltaic glass.

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211 Megunko Rd Fax: 508-881-1855
PO Box 349
Ashland MA US 01721

bbrothers@nyacol.com
http://www.nyacol.com

Nyacol offers nanosized inorganic oxides, including colloidal silica, alumina, zirconia, yttria, tin oxide, and ceria. Nanodispersions of zirconia, barium titanate, zinc oxide, yttria, and magnesium oxide in mineral spirits for MLCC applications.

NYCO MINERALS INC 518-963-4262
803 Mountain View Dr Fax: 518-963-4187
Willsboro NY US 12996

info@nycominerals.com
http://nycominerals.com

Produces and supplies wollastonite for use in whitewares, advanced ceramics, and structural clay products. General benefits of the mineral additive include improved green strength, decreased surface defects, and improved impact.

OCEAN OPTICS INC 727-733-2447
830 Douglas Ave Fax: 727-733-3962
Dunedin FL US 34698

info@oceanoptics.com
http://oceanoptics.com

Manufactures spectral instrumentation, precision optics, and optical components for online and lab UV-VIS-NIR applications. Optical-sensing systems also can be configured for testing a variety of ceramic materials, components, and coatings.

OCL INDIA LTD **+91-11-2332-12**
11th Fl Narain Manzil Fax: +91-11-2373-1333
23 Barakhamba Rd
New Delhi National Capital Territory India 110 001

ocl_delhi@ocl.com
http://ocl.com

Established 1949. Manufactures and exports refractories in basic, high-alumina, silica refractories (especially coke-oven dense-silica brick), slide gate refractories, magnesia-carbon brick, castables, C.C. refractories, gunning mix, and spray materials.

OGLEBAY NORTON INDUSTRIAL SANDS **740-342-8701**
2446 Glass Rock Rd Fax: 740-452-2822
Glenford OH US 43739

mechalcraft@oglebay.onco.com
http://oglebaynorton.com

Produces various grades of whole grain and ground silica for use in the glass, whiteware, enameling, and ceramic powder industries. Plants in Ohio, Texas, and California.

OLD HICKORY CLAY CO **270-247-3042**
962 State Rte 1241 Fax: 270-247-1842
PO Box 66
Hickory KY US 42051

ken@oldhickoryclay.com
http://oldhickoryclay.com

Established 1918. Specializes in ball clays for dinnerware, refractories, sanitaryware, tile, porcelain, glazes, and other ceramics manufacturing. Clay products available in air-floated, shredded, mechanically dried, and slurry forms.

OLEVSK PORCELAIN PLANT **+380-93-138-1823**
36 Kirova Str
Olevsk Zhytomyr Region 11000 Ukraine

info@ozef.com.ua
http://ozef.com.ua

One of the leading manufacturers of electric insulators in Ukraine and CIS (ex-USSR). Olevsk manufactures products using porcelain C 110 and C 111. Closed cycle production with forming mixes equipment. Wide range of serial and custom-made products.

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Whitesboro NY US 13492

dadelluomo@ors-labs.com
http://ors-labs.com

Offers a variety of analytical techniques to maintain and improve the quality of electronic components, printed circuit boards, and ceramics packaging. Services include internal vapor analysis, optical adhesive qualification, and outgassing/impurities.

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info@ontheplantfloor.com
http://www.ontheplantfloor.com

Manufacturing support from lab to pilot to full operation. Cost-effective equipment selection process design/improvements/material selection. Offers custom milling and consulting equipment for submicrometer milling, mixing, and dispersing.

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info@optocon.de
http://www.optocon.de

Specialists for fiber-optic temperature measurement needs. This includes fiber-optic thermometers as well as fiber-optic temperature sensors.

OPTIPRO SYSTEMS LLC **585-265-0160**
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http://www.optipro.com/

OptiPro Systems is a world leader in designing and manufacturing advanced equipment for ceramics machining and optical fabrication. OptiPro is dedicated to helping customers prosper through innovative manufacturing solutions, including CNC ultrasonic machining centers as well as CNC optical grinding and polishing machines. In addition, it provides state-of-the art contact and noncontact metrology systems.

ORTECH INC **916-549-9696**
6720 Folsom Blvd No 219 Fax: 916-404-7788
Sacramento CA US 95819

info@ortechceramics.com
http://www.ortechceramics.com

Ortech is a worldwide leader in the development and production of advanced technical ceramics. Provides a wide selection of technical and advanced ceramics, including aluminum oxide, zirconium oxide, silicon carbide, and silicon nitride.

OSRAM SYLVANIA INC **978-777-1900**
100 Endicott St Fax: 978-750-2152
Danvers MA US 01923

john.kelso@sylvania.com
http://sylvania.com

Research, development, and manufacturing of advanced ceramics for lighting applications.

OUTOTEC RESEARCH OY **+358-20-529-211**
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PO Box 69
Pori Satakunta Finland

hsc@outotec.com
http://outotec.com/hsc

Provides plants, equipment, and services based mainly on its proprietary technologies. In-house-developed HSC chemistry software simulates chemical reactions and processes on a thermochemical basis.

OWENS-ILLINOIS INC **567-336-5000**
1 Michael Owens Way
Perrysburg OH US 43551-2999

http://o-i.com

Produces glass and plastic packaging systems for the food, beverage, and pharmaceutical industries for commercial and retail use. Consulting/purchasing agreements available for technical assistance to noncompetitive glass producers and users.

OXY-GON INDUSTRIES INC **603-736-8422**
42 Old Rte 28 Fax: 603-736-8734
PO Box 40
Epsom NH US 03234-0040

sales@oxy-gon.com
http://oxy-gon.com

Manufacturer of high-temperature vacuum/controlled-atmosphere furnaces for laboratory and production applications as well as nitrogen and inert-gas gettering/purifying furnaces, hot presses, mechanical testing furnaces, and fiber-draw furnaces.

P-KER ENGINEERING **716-845-6398**
1880 Waterport Rd Fax: 716-845-6479
PO Box 26
Waterport NY US 14571

info@pkerengineering.com
http://pkerengineering.com

Manufactures and metallizes technical ceramics: alumina, beryllia, cordierite, forsterite, steatite, and zirconia. Metallize silicon nitride, SiC, and zirconia with refractory metals. Metal-ceramic joining and assemblies.

PACER CO **800-568-2492**
PO Box 912 Fax: 605-673-4459
Custer SD US 57730

pacer@gwtc.net
http://www.pacerminerals.com

Pacer offers high-quality dry-ground and chemical-free products, including potash feldspar and muscovite mica. With more than 40 years in business, it offers high-quality customer service and reliable delivery to the worldwide market.

PACIFIC CERAMICS INC **408-747-4600**
824 San Aleso Ave Fax: 408-745-6162
Sunnyvale CA US 94085-1411

info@pceramics.com
http://pceramics.com

Manufacturer of advanced microwave ceramic materials. Its products include rare-earth iron garnets, calcium vanadium garnets, lithium and magnesium ferrites, and titanate dielectrics.

PACIFIC REFRACTORIES LTD **+12-9-10223E**
Pawane Thane-Belpaur Rd
Navi-Mumbai India 400705

http://www.pacificrefractories.com

Pacific Refractories is an ISO 9001 QMS company and a leading manufacturer of quality refractories to BIS/ASTM standards. The company caters to a wide range of industries, including steel, cement, chemicals and petrochemicals, fertilizers, zinc, copper, alumina, power projects, and glass, and other critical applications against stringent specifications.

PACIFIC TRINETICS CORP (PTC) **714-484-8015**
10542 Calle Lee Ste 114 Fax: 714-484-8615
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Designs, produces, and markets prefired process equipment for manufacturers of ceramic microelectronics devices. One of only few companies with a complete range of equipment for green ceramic tape. Renowned in LTTC, HTCC, and MLCC technology areas.

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PackagingSuppliesByMail.com is a shipping supplies provider that offers an array of products including ziplock bags, shipping mailing envelopes, packing tape, stretch wraps, and medical supplies.

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info@panalytical.com
http://www.panalytical.com

Worldwide supplier of analytical instrumentation and software for X-ray diffraction, fluorescence and NIR spectrometry, and X-ray tubes. Headquarters in Almelo, Netherlands; application labs in Japan, U.S., and Netherlands; and research at University of Sussex.

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Huangjincheng Rd
Shanghai China

info@pangea-intl.com
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Chinese supplier of high-quality zirconia, rare-earth materials, and zirconia-containing ceramic microgrinding media for technical applications.

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Mesquite TX US 75149-1122

info@paragonweb.com
http://www.paragonweb.com

Paragon manufactures electric glass and ceramic hobby and studio kilns, lab furnaces, dental furnaces, and asphalt-testing furnaces. Digital and manual kilns, customized and standard. Exports worldwide. Paragon kilns and furnaces are made in the U.S.

PARTICLE TECHNOLOGY LABS 630-969-2703
555 Rogers St Fax: 630-969-2745
Downers Grove IL US 60515

experts@particletechlabs.com
http://particletechlabs.com

Premier service laboratory, dedicated to particle size and characterization. Using more than 20 technologies, PTL has significant capacity to measure particle size, concentration, and shape as well as surface area, porosity, zeta-potential, and more.

PELTSMAN CORP 763-544-5915
PO Box 27484
Minneapolis MN US 55427

mp@pelcor.com
http://www.pelcor.com

Manufactures machinery for molding ceramic and metal parts under low pressure as well as dies and mixers.

PETER PUGGER MFG INC 707-463-1333
3661 Christy Ln Fax: 707-462-5578
Ukiah CA US 95482

office@peterpugger.com
http://peterpugger.com

Manufactures clay-processing and tile-cutting/forming equipment. Machines batch mix with pugmill output. Mix, recycle, deair, and pug in a single machine with variable speed. For studio, product development, lab, and test applications.

PETER SCHULTZ CONSULTING LLC 678-575-3240
1 Evarts Ln Fax: 419-793-0492
Madison CT US 06443

pcschultz@mindspring.com
http://www.peterschultzconsulting.com

Technical and business consulting and expert witness, specializing in fused silica, fiber optics, and general glass and ceramics.

PETRO MOLD CO 814-796-6635
12775 Donation Rd
Waterford PA US 16441

petro@velocity.net
http://custommolds.net

Offers custom mold-making and mold production services to all facets of the ceramics industry. Services include original sculpting, master mold design, and production mold manufacturing. Now offers limited bisque runs from custom molds.

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PO Box 1439
Mulberry FL US 33860

jwphoenix@verizon.net
http://phoenixcoatingresources.com

Leading manufacurer of EBPVD ingots and APS powders for the aeroengine, gas turbine, and fuel cell industries. Cooperative development of new, low-k ingot materials. Sales worldwide. ISO 9001:2008 certified.

PHYSICAL ACOUSTICS CORP 609-716-4000
195 Clarksville Rd Fax: 609-716-0706
Princeton Junction NJ US 08550

sales@pacndt.com
http://mistrasholdings.com

Develops and manufactures acoustic emission sensors, instruments, and systems; C-scan ultrasonic imaging systems; automated UT systems; leak detection instrumentation; and portable eddy current devices. Also performs reliable AE field-testing.

PLANSEE SE +43-5672-60-0
Metallwerk-Plansee-Str 71
6600 Reutte
Reutte Tyrol Austria 6600

furnace.construction@plansee.com
http://plansee.com

Manufactures heating elements of molybdenum, tungsten, and tantalum for use in vacuum and protective-atmosphere furnaces up to 4,350°F (2,400°C). Local production and sales in Asia, Europe, and U.S. Advanced material qualities available (ML, TZM, WVM).

PLASMA ETCH INC 775-883-1336
3522 Arrowhead Dr Fax: 775-883-2559
Carson City NV US 89706

sales@plasmaetch.com
http://plasmaetch.com

OEM manufacturer of (plasma) surface modification systems. Patented process temperature control and patented electrostatic shielding. Excellent throughput, excellent uniformity, and superior ceramic applications.

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1-23 Shiba 4-chome Fax: +81-3-3455-1362
Minato-ku
Tokyo Tokyo Japan 108-0014

k-hirasawa@plibrico.co.jp
http://plibrico.co.jp

Established in 1954 under technology transfer from Plibrico USA. Manufactures monolithic refractories in factory located in Yokohama, Japan. A wholly owned subsidiary in China produces the same range of products.

POLYMER INNOVATIONS INC 760-598-0500
2426 Cades Way Fax: 760-727-3127
Vista CA US 92081

info@polymerinnovations.com
http://www.polymerinnovations.com

Polymer Innovations is a consulting and manufacturing company focused on water-based tape-casting technology and polymer solutions for the electronics and energy fields. Leading expert in tape casting, formulation of green tapes, and inks.

PORTLAND CEMENT ASSN 847-966-6200
5420 Old Orchard Rd Fax: 847-966-6221
Skokie IL US 60077-1083

cfield@portcement.org
http://cement.org

Conducts extensive research, market development, and educational work on behalf of its members (cement companies in the U.S. and Canada). In Canada, operations are conducted by the Cement Association of Canada.

POWDER PROCESSING & TECHNOLOGY LLC 219-462-4141
5103 Evans Ave Fax: 219-462-0367
Valparaiso IN US 46383

sales@pptechnology.com
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Developer and custom processer of inorganic chemical and ceramic powders. Production and pilot processing capability includes calcining, milling, spray drying, and sintering. Partnered with industry in electronics and advanced ceramics.

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SUPERIOR GRAPHITE CO 312-559-2999
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Chicago IL US 60606

dlaughton@superiorgraphite.com
http://www.superiorgraphite.com

Produces alpha- and beta-SiC powder for use in sintered wear parts, toners, MMCs, and abrasives. Produces PS SiC tile for armor. Produces advanced (graphite) materials for use in many industries.

SUPERIOR QUARTZ PRODUCTS INC 610-317-3450
2701 Baglyos Cir Fax: 610-317-3451
Bethlehem PA US 18020

superior@sqpuv.com
http://sqpuv.com/ceramics/ceramics.html

SUPERIOR TECHNICAL CERAMICS CORP 802-527-7726
600 Industrial Park Rd Fax: 802-527-1181
St Albans VT US 05478

sales@superiortechceramics.com
http://www.ceramics.net

Established 1898. Manufactures custom technical ceramics components using extruding, dry-pressure, isopressing, green-forming, and diamond-machining techniques. Also manufactures prototype-through-production quantities on contract.

SURMET CORP 781-272-3969
31 B St Fax: 781-272-9185
Burlington MA US 01803

sales@surmet.com
http://www.surmet.com

A specialty materials manufacturing company known for its leadership in AlON, the superior lightweight transparent armor. Surmet's transparent spinel is stronger and tougher. Surmet produces and supplies aluminum nitride powder/products in tons.

SWECO 800-80-SWECO
8029 Dixie Hwy Fax: 859-283-8469
Florence KY US 41042

info@sweco.com
http://www.sweco.com

Established in 1917, Sweco manufactures processing equipment, including wet- and dry-grinding and dispersion mills for fine particle-size reduction and deagglomeration; separators for sizing and filtering wet or dry materials; and more.

SWINDELL DRESSLER INTL CO 412-788-7100
5100 Casteel Dr Fax: 412-788-7110
Coraopolis PA US 15108

salesSDIC@swindelldressler.com
http://www.swindelldressler.com

Established in 1915, Swindell Dressler engineers, designs, and constructs shuttle, bell, electric, roller hearth, and tunnel kilns for the ceramics and carbon industries. The company also offers car-moving equipment.

SYMPHONY TRADECOMM PVT LTD +91-9301180677
Manish Shadija Fax: +91-7714010200
Raipur Chhattisgarh India 493221

symphonytpl@yahoo.com
http://www.indiamart.com/symphony-tradecomm

Manufactures microsilica and amorphous silica for several uses. Also manufactures rice husk ash tundish covering product for ironmaking and steelmaking as well as a product for super concrete based on rice husk ash.

TA

TA INSTRUMENTS 302-427-4000
159 Lukens Dr Fax: 302-427-4001
New Castle DE US 19720

info@tainstruments.com
http://thermophysical.tainstruments.com

TA Instruments, the world leader in thermal analysis, rheology, and calorimetry, provides innovative technology for advanced materials characterization by DSC/TGA, dilatometry, thermal conductivity and diffusivity, high-temp viscometry, and more.

T Q ABRASIVE MACHINING 714-972-2047
3338 W Castor St Fax: 714-972-2067
Santa Ana CA US 92704

info@tqabrasivemachining.com
http://tqabrasivemachining.com

Offers precision ceramic machining of complex designs for a wide range of industrial applications. Designs and manufactures advanced technical ceramic precision components and parts.

TABER INDUSTRIES 716-694-4000/800-333-5300
455 Bryant St Fax: 716-694-1450
North Tonawanda NY US 14120

sales@taberindustries.com
http://taberindustries.com

Manufacturer of test instruments that aid the understanding of material physical properties, including abrasion and scratch resistance. Test results assist R&D, process control, and quality assurance for ceramics, coatings, and other materials.

TAKASAGO INDUSTRY CO LTD +81-572-598899
2321-2 Dachi-cho Fax: +81-572-593848
Toki-city Gifu Japan 509-54

hitoshi_ando@takasago-inc.co.jp
http://www.takasago-inc.co.jp

Designs and manufactures electric-heated and gas-fired industrial kilns. Specializes in roller hearth kilns, rotary kilns, tunnel kilns, periodic kilns, including shuttle kilns, microwave kilns, microwave-electric or -gas hybrid kilns, and various dryers.

TAM CERAMICS 716-978-9403
4511 Hyde Park Blvd Fax: 716-278-9571
Niagara Falls NY US 14305-1215

ehanson@tamceramics.com
http://www.tamceramics.com

Leading manufacturer of high-purity engineered powders, including zirconia-titanate and zircon-based materials for a variety of industries and appli-cations. Provides services such as custom toll processing and materials recycling.

TAPE CASTING CONSULTANTS INC 215-493-6470
1038 Lafayette Dr
Yardley PA US 19067

drblade@juno.com

Established 1983. Consulting services for technical ceramics, specializing in tape-casting technology.

TAPE CASTING WAREHOUSE DIV 800-641-1034
1037 Lafayette Dr Fax: 215-321-0805
Yardley PA US 19067

tapecast@juno.com
http://www.drblade.com

Established 1983. Stocks and sells materials and equipment for tape casting.

TAYLOR TUNNICLIFF LTD +44-1782-501
Normacot Rd Longton Fax: +44-1782-328807
Stoke-on-Trent Staffordshire UK ST3 1PA

info@taylortunnicliff.co.uk
http://taylortunnicliff.co.uk

Manufactures pyrometric devices, Bullers Rings, bars, and disks used by ceramics-manufacturing companies. Contract spray-drying facility. Agents and distributors worldwide.

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45 Evans St Fax: +44-1782-328807
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shamus@southernequity.com.au
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328 Commerce Dr Fax: 203-368-1922
Fairfield CT US 06825

tonyr@technisonic.net
http://technisonicinc.com

Manufactures ultrasonic transducers for nondestructive-testing applications, including flaw detection, thickness gauging, and weld inspection. Medical and industrial types are offered.

TECHNOLOGY ASSESSMENT & TRANSFER (TA&T)
133 Defense Hwy Ste 212 410-224-3710
Annapolis MD US 21401 Fax: 410-224-4678

info@techassess.com
http://www.techassess.com

Sputtered thin films; chemical vapor infiltration ceramic composites; spinel; monolithic transparent ceramics; laser gain media; strengthened carbon foams; 3-D printing of ceramics; direct manufacturing of ceramic microdevices and quasicrystal coatings.

TECHNOLOGY OF MATERIALS 800-682-2922
4020 N Palm St #202 Fax: 714-446-9229
Fullerton CA US 92835

sam@xraydiffrac.com
http://xraydiffrac.com

Analytical lab specializing in analysis of materials using XRD (Rietveld quantification and size/strain), thermal analysis (DTA/TG), microscopy (SEM/EDS), and FT-IR. Also specializes in clay and soil mineralogy.

TEETER MARKETING SERVICES LLC 716-510-1408
115 Sand Dollar Ln
Sarasota FL US 34242-1335

cereng19@aol.com

Provides industrial market research, business planning, product development and introduction, marketing communications, and education and training services for companies in the high-performance materials field. Serves as managing director for SECA.

TEMPO
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TEMPO PLASTIC 800-350-7711
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Visalia CA US 93291

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peter.sharp@tenmat.com
http://tenmat.com

Produces high-performance engineering ceramics, including reaction-bonded SiC, Refel and mechanical seals and wear parts for mineral separation equipment. Produces reaction-bonded Nitrasil R for induction heating, welding, and more.

TERIO CORP +86-532-86069596
18/A Huaren Intl Bldg 2A Fax: +86-532-83893695
Shandong Rd
Qingdao Shandong China 266071

jackyan@teriocorp.com
http://www.terio.cn

Established 1993. A diversified chemical company with a strong reputation in zirconia, YSZ, SSZ, LSM, YTP, barium carbonate/hydroxide, and zirconium acetate. Operates four factories in China. A Responsible Care company and ISO 9001/14001 certified.

TETHON 3D 402-889-6191
PO Box 31727 Fax: 402-504-9605
Omaha NE US 68131

karen@tethon3d.com
http://www.tethon3d.com

Tethon 3D provides innovative products and service for ceramic additive manufacturing (3-D printing).

TEVTECH LLC 978-667-4557
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North Billerica MA US 01862

http://www.tevtechllc.com

TevTech delivers state-of-the-art materials processing, high-temperature vacuum furnace systems and components that enable companies to maintain a competitive edge.

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info@texers.com
http://www.texers.com

Texers is a growing international technical ceramics company. It designs, produces, and supplies ceramic products and components engineered to customer needs. Texers supplies a wide spectrum of industries, including automotive and aerospace; medical and healthcare; oil, gas, and petrochemical; energy and environment; and food and agriculture.

TFD INC 714-630-7127
1180 N Tustin Ave Fax: 714-630-7119
Anaheim CA US 92807

sales@tfdinc.com
http://www.tfdinc.com

Manufacturer of thin film coatings.

THALES TRT +33-1-69-41-58-91
Rd 128
Palaiseau Paris Ile-de-France France 91767

jean-pierre.ganne@thalesgroup.com
http://www.thalesgroup.com/Group/Innovation

Provides R&D on electroceramic materials and devices.

THE AMERICAN CERAMIC SOCIETY 866-721-3322
600 N Cleveland Ave Ste 210 Fax: 240-396-5637
Westerville OH US 43082

customerservice@ceramics.org
http://www.ceramics.org

ACerS is a nonprofit professional society for individuals involved in materials science and engineering. The Society's mission is to advance the study, understanding, and use of ceramics and related materials, for the benefit of our members and society.

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Fabricates and distributes ceramic fiber and biosoluble insulation, ceramic fiber modules, and SiC heating elements. Die-cutting and slitting capabilities of insulation. Ceramic fiber braids for kiln car seals and door gaskets. Large modules for kilns.

THERMAL WAVE IMAGING INC 248-414-3730
845 Livernois St
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dmurdock@thermalwave.com
http://thermalwave.com

Develops and manufactures pulse thermographic NDT equipment.

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Winston Salem NC US 27107

info@thermcraftinc.com
http://www.thermcraftinc.com

Provides furnaces for industrial, R&D, OEM, and end users for all industries. Manufactures lab- and industrial-heating elements, furnaces, and control systems. Systems are available for temperatures to 1,700°C.

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650 Colfax Ave Fax: 859-291-1849
Bellevue KY US 41073

info@thompsonenamel.com
http://thompsonenamel.com

Manufactures jewelry enamel frits for application onto copper and precious metals. Catalog supplier to artists and hobbyists. Offers custom smelting of porcelain enamels and glasses for industry.

THROUGHPUT BLUESTREAK 888-785-0509
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http://www.go-bluestreak.com

Bluestreak software is enterprise-level manufacturing software designed specifically for process-based manufacturers that work with ceramics powder/paint, metal finishing, heat treat, etc. Bluestreak manages real-time information across manufacturing departments.

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Tanggu Tianjin China 300450

leo_lpxz@yahoo.com.cn
http://innovatj.com

Supplies zirconia-derivative products, such as high-purity zirconia, yttria-stabilized zirconia (YSZ or TPZ), TPZ milling media, and structural zirconia ceramics.

TILE HERITAGE FOUNDATION 707-431-8453
PO Box 1850 Fax: 707-431-8455
Healdsburg CA US 95448

foundation@tileheritage.org
http://tileheritage.org

Established 1987. Nonprofit historical organization dedicated to research and preservation and to promote an awareness and appreciation of ceramic surfaces in the U.S.

TOGNI SA MATERIAIS REFRACTARIOS +55-35-2101-2222
R Antonio Togni 2439-CP 598 Fax: +55-35-3714-2420
Pocos de Caldas Minas Gerais Brazil 37704-356

togni@togni.com.br
http://togni.com.br

Producer of shaped and unshaped refractories, including magnesia, magnesia-carbon, magnesia-chrome, high-alumina, mullite, and alumina-carbon.

TOTO LTD +81-467-54-3310
281 Honson Kanagawa-Pref
Chigasakai-City Japan 253-8577

http://www.toto.com

New technology demands ceramic materials with higher performance and improved functions in terms of design, durability, thermal resistance, and electrical characteristics. Toto has a reputation for making quality ceramics for the semiconductor manufacturing equipment industry. It is known for manufacturing high-precision ceramic products, including air bearings, electrostatic chucks, and bonding capillaries.

TOYAL AMERICA INC 630-505-2170
1717 N Naper Blvd Fax: 630-505-2176
Naperville IL US 60563

nicolas.justeau@toyala.com
http://toyala.com

Producer and distributor of various grades of aluminum nitride for sintering. Also produces silica-coated aluminum nitride with excellent thermal conductivity properties. Offers atomized spherical and conventional aluminum powders.

TOYOTA CENTRAL R&D LABS INC +81-561-63-6419
41-1 Yokomichi
Nagakute Aichi Japan 480-1192

http://www.tytlabs.com

Producer and distributor of various grades of aluminum nitride for sintering. Also produces silica-coated aluminum nitride with excellent thermal conductivity properties. Offers atomized spherical and conventional aluminum powders.

TRANS-TECH INC 301-695-9400
5520 Adamstown Rd Fax: 301-695-7065
Adamstown MD US 21710

transtech@skyworksinc.com
http://www.trans-techinc.com

Manufactures ceramic components for rf, microwave, and specialty powder applications. Products include dielectric resonators, coaxial resonators, band-pass filters, ferrite phase shifter elements, ferrite circulator and isolator elements, and ferrites.

TREBOL USA LLC 843-530-1102
641 Rosemary Ave Fax: 843-264-3616
Andrews SC US 29510

rphillips@gtrebol.com
http://www.gtrebol.com/en/index.php

Trebol USA is manufacturer and international supplier of raw materials for the ceramic, chemical, and foundry industries. Trebol USA is a recognized supplier of zircon opacifiers, flours, and sands of the highest quality.

TREIBACHER INDUSTRIE AG +43-4262-5054-410
Althofen Carinthia Fax: +43-4262-505-8410
Austria 9330

helene.leitner@treibacher.com
http://treibacher.com

Established 1898. Makes rare earths, rare-earth oxides, and rare-earth oxide compounds for several applications. The product portfolio also includes a broad range of carbide, boride, and nitride powders.

TREIBACHER SCHLEIFMITTEL NORTH AMERICA INC
2000 College Ave 800-394-8872
Niagara Falls NY US 14302 Fax: 716-286-1224

marketing@treibacher-us.com

Manufactures fused aluminum oxide and silicon carbide grains for use in production of grinding wheels, sandpaper, refractories, compounds, and composites. Other uses include pressure blasting, polishing, and deburring.

TRENT INC 215-482-5000
201 Leverington Ave Fax: 215-482-9389
Philadelphia PA US 19127

trentheat@aol.com
http://trentheat.com

Manufactures electrically heated process equipment for industrial applications. Manufactures furnaces and ovens for the glass and ceramics industries as well as replacement heating elements.

TRI-MER CORP 801-294-5422
1400 Monroe St Fax: 989-723-7844
Owosso MI US 48867

kevin.moss@tri-mer.com
http://www.tri-mer.com

Glass furnace emissions: UltraCat Catalyst Filters are the technology of choice for container and flat glass. Also kilns, ceramic production, and cement. Remove any combination of PM, SOx, and NOx, HCl, HF, and metals to below EPA standards.

TRIANGLE CERAMICS 919-415-1546
991 Aviation Pkwy
Morrisville NC US 27560

http://triangleceramics.com

Produces aluminum nitride and tantalum carbide parts, components, and bulk stock material. The highest melting point material on earth, TaC is a high-hardness electrical conductor, while AlN is an excellent thermal conductor and electrical insulator.

TRINITY CERAMIC SUPPLY INC 214-631-0540
9016 Diplomacy Row Fax: 214-637-6463
Dallas TX US 75247

trinityceramic@sbcglobal.net
http://trinityceramic.comt

Established 1950. Distributes raw materials and chemicals to the tile, sanitaryware, brick, porcelain enamel, artware, and hobby industries. Inventories include opacifiers, kaolins (foreign and domestic), feldspars, nepheline syenite, and ball clays.

TSI INC 651-490-2811
500 Cardigan Rd Fax: 651-490-3824
Shoreview MN US 55126-3996

particle@tsi.com
http://tsi.com

Established 1966. Develops aerosol research instrumentation. Offers complete solutions for sizing, counting, characterizing, generating, and dispersing aerosol particles.

UKAM INDUSTRIAL SUPERHARD TOOLS 661-257-2288
28231 Ave Crocker Unit 80 Fax: 661-257-3833
Valencia CA US 91355

lel@ukam.com
http://ukam.com

Manufactures ultrathin and high-precision diamond blades, diamond drills, 0.001-in.- to 48-in.-diameter dicing blades, lab dicing saws, sectioning saws, grinders, and polishers for sample preparation. Manufactures custom industrial diamond tooling.

UMG - UNITED MINERALS GROUP +38 44 590 6444
Rozy Luxemburg 48b
Ukraine Ukraine 83050

info@umgukraine.com.ua
http://umgukraine.com

United Minerals Group is the largest Ukrainian white plastic ball clay extracting group. The clay produced by UMG is considered to be ideally suitable for porcelain tile (gres). It brings high whiteness, strength, and plasticity.

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Global leader in the development and manufacture of high-temperature insulation products, including Fiberfrax ceramic fiber, and revolutionary Insulfrax and Isofrax soluble fiber products.

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New Canaan CT US 06840 Fax: 203-972-1378

contactus@qualityceramics.com
http://www.unimin.com

Unimin offers a complete portfolio of fillers, fluxes, clays, custom blends, and prepared bodies. Engineered to the highest quality standards, it supplies the global ceramic industry with proven, performance, oriented industrial minerals.

UNION PROCESS 330-929-3333
1925 Akron Peninsula Rd Fax: 330-929-3034
Akron OH US 44313

unionprocess@uninprocess.com
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Manufacture equipment for fine grinding of ceramic products and equipment designed to provide rapid reduction of particles, in some cases, submicron in size. Narrow particle size attainable.

UNIVERSAL TECHNICAL EQUIPMENT 800-932-8653
1100 Woodlawn Ave Fax: 610-586-0151
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uteinc@verizon.net

Provides equipment, supplies, and accessories for nondestructive testing and evaluation.

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San Nicolas de los Garza
Nuevo Leon Mexico 66450

infoecomateriales@gmail.com
http://www.uanl.mx

Universidad Autonoma de Nuevo Leon is a public university with seven campuses across Nuevo Leon, Mexico. It is the oldest and largest university in the state in terms of student population.

UNIVERSITY OF STUTTGART/MTCC&C +49-711-685-68300
Allmandring 7b Fax: +49-711-685-68299
Stuttgart Baden-Wurttemberg Germany 70569

rainer.gadow@ifkb.uni-stuttgart.de
http://uni-stuttgart.de/home

Main material R&D of new manufacturing technologies for ceramic components and composites, focused on structural/functioning ceramics, fiber-reinforced materials, surface/coating technologies, numerical process simulations, and materials characterization.

US FOAM CORP 800-830-2183
7412 Jager Ct Fax: 513-528-9802
Cincinnati OH US 45230

promgrusf@fuse.net
http://us-foam.com

Manufactures various high-quality hydrophilic grout sponges, nonabrasive epoxy sponges, specialty sponges, nylon scrub pads, laminate underlayment, and quality diamond saw blades.

US SILICA CO 800-345-6170
8490 Progress Dr Ste 300 Fax: 304-258-8295
Frederick MD US 21740

sales@ussilica.com
http://www.u-s-silica.com

Produces aplite, round angular, and subangular whole-grain sand, ground silica, fine-ground silica, and assorted clay materials. Materials available in bulk and bagged quantities.

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26 Kwai Cheong Rd Fax: +86-757-63825886
Hover Industrial Building
Kwai Chung China 528200

usenhk@outlook.com
http://www.usenco.net

Produces inorganic materials for industrial applications, such as ceramic pipe, firebrick, kiln parts-sagger, T-rack, and plate, mainly using raw materials cordierite–mullite, silicon carbide, high-alumina, and zirconia. Customized products available.

UV PROCESS SUPPLY INC 773-248-0099
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info@uvps.com
http://www.uvprocess.com

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info@valleydesign.com
http://valleydesign.com

Manufactures substrates, windows, wafers, shims, and spacers from ceramics, glass, and metals. Precision lapping, polishing, four-axis CNC machining, dicing, edge-polishing, thinning, and grinding services. Specializes in ultrathin, ultraflat superpolishing.

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PO Box 5150 Fax: 203-855-1220
Norwalk CT US 06856-5150

rjohnson@rtvanderbilt.com
http://www.vanderbiltminerals.com

Vanderbilt Minerals LLC specializes in industrial minerals and chemicals, including kaolin clays, pyrophyllite, wollastonite, smectite and hectorite clays, dispersing agents, and xanthan gum.

VECTOR TECHNOLOGIES INC 414-247-7100
6820 N 43rd St Fax: 414-247-7110
Milwaukee WI US 53209

sales@vector-vacuums.com
http://vector-vacuums.com

Designs and manufactures industrial vacuums for brick, clay, and ceramic-tile industries.

VELCO GMBH +49-2051-2087-0
Haberstr 40 Fax: +49-2051-2087-20
Velbert North Rhine-Westphalia Germany 42551

info@velco.de
http://velco.de

Produces gunning machines, gunning robots for hot repair of EAF, ladle, RH, etc. Pneumatic injection machines for the steel industries. Using the patented GUNMIX system, it is possible to apply LC qualities in dry gunning.

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info@verder-scientific.us
http://www.verder-scientific.com

Verder's Scientific Division sets standards in high-tech equipment for quality control, research, and development of solid matter. Fields of activity cover sample preparation of solids as well as analyzing technology.

VERITY TECHNICAL CONSULTANTS LLC 614-440-1306
1266 Dobbins Dr Fax: 614-254-1040
New Albany OH US 43054-9409

djeter@verityconsultants.com
http://www.verityconsultants.com

Verity provides manufacturing consulting, technical investigations, analysis, reports, and testimony for the resolution of litigation and claims involving failures of glass and ceramic materials, product liability, and industrial workplace accidents.

VESCO JSC +38-6267-34542
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Druzhkovka Ukraine Ukraine 84205

vesco@vesco.Ukraine.ua
http://vesco.dn.ua

Produces, distributes, and exports clay mixtures of various chemical composition according to customer specification.

VESUVIUS 843-774-6026
753 Enterprise Rd Fax: 843-774-3735
Dillon SC US 29536

debbie.alexander@us.vesuvius.com
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Vesuvius is a worldwide leader in advanced ceramics for the solar, glass-tempering, and glass-forming industry.

VIDEOJET TECHNOLOGIES INC 800-843-3610
1500 Mittel Blvd Fax: 630-616-3623
Wood Dale IL US 60191-1073

info@videojet.com
http://videojet.com

Manufactures and distributes large- and small-character ink-jet and laser-coding systems, labeling systems, ink-jet inks and accessories, and inline control systems. Products sold and serviced worldwide.

VIRIDIS3D LLC 978-455-0131
92 Bolt St
Lowell MA US 01852

sales@viridis3d.com
http://www.viridis3d.com

Develops and commercializes materials for advanced applications in additive manufacturing, including technical and art ceramics, metal casting. Provides complete solutions with hardware, software, installation, training, and materials.

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Brislington
Bristol UK BS4 5NZ

info@vitcas.com
http://www.vitcas.com

British manufacturer of refractory cement, fire cement, refractory castables, fire bricks, ceramic fiber products, acid resistant cements, zircon refractory products, coatings, tap hole clays, refractory moldables, taming mix, and high alumina mortars.

VITO - FLEMISH INSTITUTE FOR TECHNOLOGICAL RESEARCH +32-14-335665
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Boeretang 200
MOL Belgium 2400

frans.snijkers@vito.be
http://www.vito.be

Research in processing of ceramic materials, fabrication of technical and functional ceramics, porous structures, prototypes, and small series. Spray drying, granulation, powder compaction, cold isostatic pressing, sintering, and hard machining.

VITTA CORP 203-790-8155
7 Trowbridge Dr Fax: 203-778-6478
Bethel CT US 6801

info@vitta.com
http://vitta.com

Produces metalizing, conductive, glazing, glass-sealing, ceramic, silver and transfer tapes, pastes, and tape-transfer machines for their application. Provides transfer preforms for manual or automated systems. Custom fabricates transfer tapes.

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Manufactures fused synthetic minerals for use in refractory raw materials, abrasives, ceramic raw materials, and industrial applications. Products include silicon carbide, brown fused alumina, white fused alumina, boron carbide, and bubble alumina.

WCS INC 323-222-1141
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Established 1912. Represents manufacturers of equipment for the heavy-clay products industry, including extruding, grinding, screening, conveying, automatic handling, burning, and drying equipment.

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Provides precision diamond wire saws designed for testing and production (up to 630 mm in diameter) as well as precision high-speed wire saws that use an endless diamond wire.

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wmjones@wesbond.com
http://wesbond.com

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St Louis MO US 63102 Fax: 314-436-2639

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http://www.innovacera.com

Innovacera's main business is to produce metallization ceramics and ceramics components at customer request.

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upt100@unipretec.com
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Unipretec is a professional manufacturer for advanced ceramics. Materials include alumina ceramic, zirconia ceramic, boron nitride, and machinable glass-ceramic. Aims to provide high-quality products and solutions for customers.

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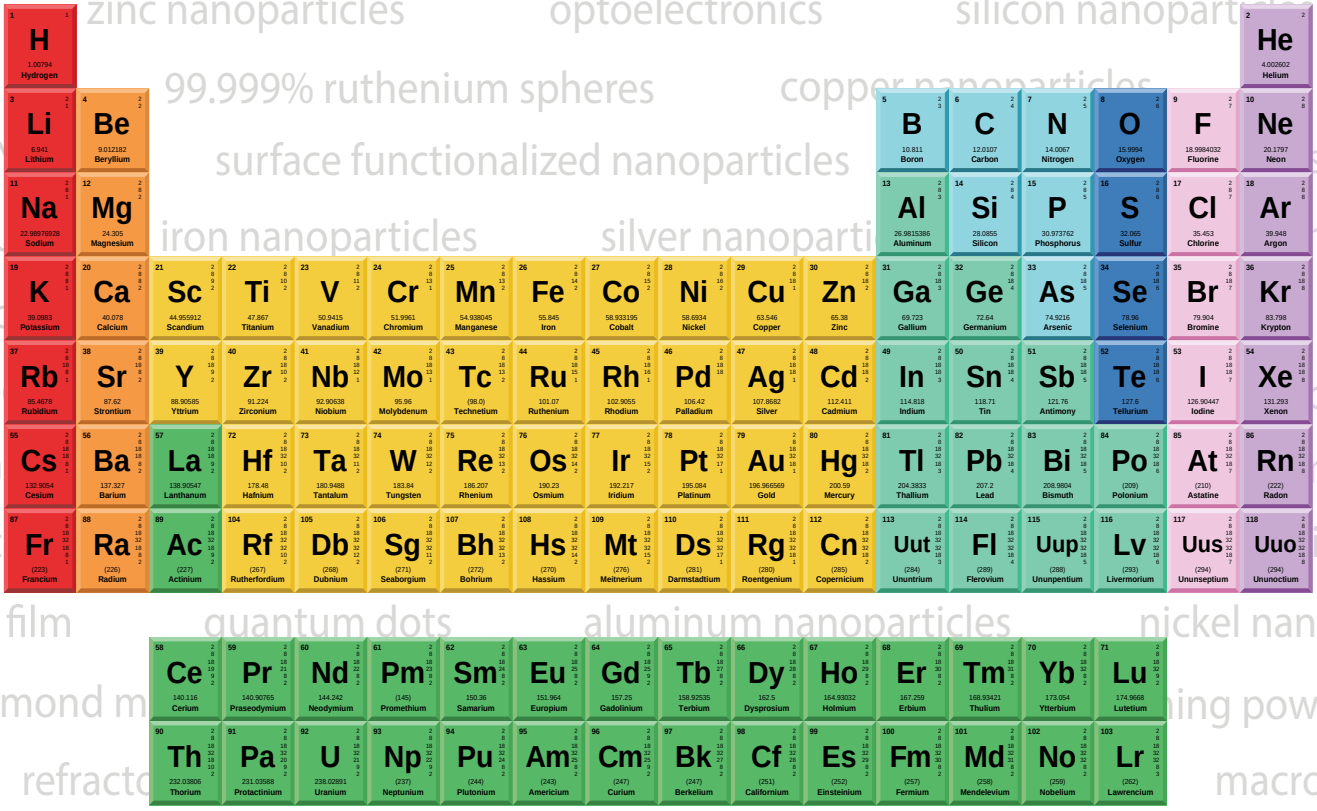

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