India: Crossroads of traditional and advanced ceramics

Although the sudden IT boom has diverted some skilled engineers and technical workers from more traditional fields of research to this new area of interest, many of India’s historically recognized ceramic sectors are experiencing rapid growth and laying the foundation for market expansion.

By Alex Talavera and Randy B. Hecht

Within the international market, India is perhaps best known for the many professionals employed in the information technology industry. However, as its rise to prominence as a major player in the global economy gives birth to a huge new middle class in the world’s second most populous country, consumer and industrial demands are sparking new growth in the traditional ceramics industries.

Advanced ceramics R&D related to, for example, energy and biomedical applications, is emerging in India. However, much of the research focus has been on traditional applications, such as whitewares and structural ceramics. Moreover, national institutes and some private companies are pursuing advanced research that is expected to change the landscape of India over the long term. On the other hand, for now, perhaps the most prominent sectors are industrial ceramics, particularly refractories and glass.

“Presently, our country is pitching for improving the infrastructure sectors consisting of metallurgical, cement and thermal power plants; commercial and residential buildings; and roads and bridges. Therefore, the emphasis with regard to ceramics is on bulk refractory products based on silica, aluminosilicates, alumina, magnesia, spinel, silicon carbide, zircon(ia) and combinations thereof,” says A.L. Shashi Mohan, president of the Indian Ceramics Society. “As far as glass products are concerned, newer plants for float glass and container glass have sprung up and are springing up regularly to meet the demands of the growing middle-class population. Here, the trend seems to be toward green buildings and the like.”

InCerS, an influential group within the nation’s ceramics and glass communities for more than 75 years, is organized in 14 local chapters that include individuals and corporations among their members. InCerS sponsors a multiday annual national meeting. The chapters, depending on their size, host monthly or quarterly events that range from presentations by subject matter experts to forums in which university students and companies have an opportunity to interact. The goal is to promote networking and information sharing within the industry and to encourage a collaborative approach to seeking solutions to engineering challenges. In addition, InCerS works in association with other professional societies to “enthusiastically pursue careers in science and engineering,” Mohan says. The organization does not have a formal program dedicated to encouraging interest in ceramics careers. However, Mohan says its members work individually toward that end in anticipation of increased need for professionals as the industry continues to grow.

Refractories positioned for continued growth

India has seen a strong increase in demand in the areas of fired, nonfired and fusion-cast refractories for metallurgical, power and structural- and container-glass plants. The “significant upsurge” in refractories has been sparked by expansion in ironmaking and steelmaking as well as new thermal and nuclear power plants, Mohan says. “The only hitch is with regard to obtaining requisite land and environmental clearances.” He notes that Greenpeace and other environmental activists have kept one nuclear power plant in the south of India dormant for almost a year.

“Refractories for metallurgical industries and power plants have the greatest scope for growth,” he adds, citing such prominent companies—and InCerS members—as TRL Krosaki Refractories, Calderys India Refractories, Vesuvius India and IFGL Refractories. “All these have technical research and manufacturing collaborations with leading refractory makers from across the world.”

Siddharth Kumar is president of ACE Calderys, which commands 40 percent of the monolithics market in India. The company produces and sells annually almost 185,000 tons, and Kumar anticipates continued growth over the next five years, predominantly in the area of aluminosilicates.

Most competing companies have a market share of 10–15 percent, and market growth will lead to some consolidation, he says. “Some has already happened. But, many companies are small, fragmented, family owned and may not be interested in consolidation. Fortunately, the market is growing, so
From emerging market to economic powerhouse

India’s economic growth spurt sets the stage for greater global opportunity.

By Alex Talavera and Randy B. Hecht

Any understanding of the Indian market must begin with comprehension of its size. The country is a behemoth by any demographic or economic measure. Its population, estimated in July 2012 at 1.2 billion people, represents approximately 17.1 percent of the entire population of the planet. Its active labor force alone is approximately 55 percent bigger than the total US population—487.6 million versus 313.8 million people.

Although a quarter of its population lives below the poverty line, the US State Department notes, “There is a large and growing middle class of more than 50 million Indians with disposable income ranging from 200,000 to 1,000,000 rupees ($4,166 to $20,833) per year. Estimates are that the middle class will grow tenfold by 2025.” That upward mobility is expected to create a new demand for a wide variety of goods, including a large volume of ceramic products—beginning with household basics and, with increased economic growth, moving on to anything from high-end decorative glass and tile to medical and dental devices.

An example of the former was the subject of a recent Harvard Business Review online report. Author Alfredo Behrens observed that India “expects to see some 350–400 million people becoming urban residents in the next three decades. That could mean demand for as many as 150 million new toilets.”

But, “the world demand and supply gap is daunting,” writes Behrens, a professor of cross-cultural management at the Fundação Instituto de Administração in São Paulo, Brazil. His story noted, for example, that most of the 20 million toilet units produced each year by Kohler are “unsuitable for low-income markets” and that although India and China are undergoing a “reconversion from tile to ceramic sinks and toilets … Italy, first in tile sales, and the United Arab Emirates, first in tile volume, have yet to adjust.” And that’s just one marker of the approaching market opportunity, he added: “Additional demand for new toilets, and derived demand for raw materials and energy, is only the tip of the housing demand iceberg coming from emerging markets.”

Building economic muscle

The Indian economy has thrived during the global economic crisis. Gross domestic product grew 6.6 percent in 2009, 10.6 percent in 2010 and 7.2 percent in 2011. Calculated on the basis of the official exchange rate, 2011 GDP was $1.676 trillion. However, economists often calculate “purchasing power parity GDP” as a more accurate gauge for comparing the economic performance of one country against that of another. The International Monetary Fund explains, somewhat longwindedly, that purchasing power parity GDP figures reflect “the rate at which the currency of one country needs to be converted into that of a second country to ensure that a given amount of the first country’s currency will purchase the same volume of goods and services in the second country as it does in the first.” India’s purchasing power parity GDP for 2011 was $4.515 trillion, or $3,700 per capita. This is the world’s fourth highest for the year, after the European Union, the United States and China, and it is just ahead of Japan and Germany. Industry occupies 14 percent of the workforce but generates more than 36 percent of GDP. Leading industries include textiles, chemicals, food processing, steel, transportation equipment, cement, mining, petroleum, machinery, software and pharmaceuticals. Services occupy 34 percent of the workforce and generate more than 56 percent of GDP. Agriculture, which employs 52 percent of the workforce, generates only 17 percent of GDP.

The trade perspective

The US is India’s third-largest source of imports, second-largest market for exports and largest investment partner. “Principal US exports are diagnostic or lab reagents, aircraft and parts, advanced machinery, cotton, fertilizers, ferrous waste/scrap metal and computer hardware,” the State Department reports. “Major US imports from India include textiles and ready-made garments, Internet-enabled services, agricultural and related products, gems and jewelry, leather products and chemicals.” Indian export volume reached almost $300 billion in 2011, up from $225 billion in 2010, and imports increased to more than $461 billion in 2011 from $358 billion in 2010. As these numbers demonstrate, the market opportunity is enormous, but so are the challenges. Among the constraints to economic growth cited by the State Department are “inadequate infrastructure, a cumbersome bureaucracy, corruption, labor market rigidities, regulatory and foreign investment controls, the ‘reservation’ of key products for small-scale industries and high fiscal deficits.”

For guidance on competing successfully in India and connecting with local trading or business partners, contact the American Chamber of Commerce in India, the US India Chamber of Commerce, or the US India Business Council. Madhvi Kataria, deputy executive director of the American Chamber of Commerce in India, also recommends reviewing online guides to doing business in India published by Ernst & Young, KPMG, and HSBC, in partnership with PricewaterhouseCoopers.

Crossroads of traditional and advance ceramics

everybody is surviving.”

Little research is done in areas other than monolithics, Kumar says. “Because even if [manufacturers] come out with some product, they fear that they will not be competitive on price—against China or other developing countries—or technology—against European countries. Even if they come up with a good product, it will not be economically viable. So I don’t see much development on the basic refractory front, but for monolithics. Even our company is continuously engaged in [monolithics] development work.”

One challenge the industry faces is obtaining a sufficient quantity and quality of some raw materials. Some shortages are creating a growing discussion about the need for synthetic raw materials.

Competition for talent also has posed some difficulties, but that is changing in response to the growth of the middle class and the resulting increased domestic demand for steel, concrete/cement and power. Kumar notes that as information technology triggered the first wave of India’s emergence as a global economic power, most college graduates sought IT jobs. “Ceramic engineers were going for IT companies. Civil engineers, mechanical engineers—they were all looking for IT jobs. The last decade and a half, we were really facing a problem attracting good engineers,” he says. The landscape changed as the ceramics sector’s fortunes rose and companies in the industry could offer competitive salaries. “They are paying comparable to IT industry, if not better. Now we see some change, and people are now willing to continue in the ceramics industry. I think we will not have a problem of lack of talent in the field.”

A broad range of research initiatives

Most ceramics research in India is conducted at publicly funded laboratories. “There is a vast scope for indigenous research and development work in our country,” Mohan says. “The government, off and on, comes out with research-friendly policies like tax exemptions and weighted deductions in tax for specified types of research and develop-
India’s Central Glass and Ceramic Research Institute, which has its roots in InCerS, established a Fuel Cell and Battery Division in 2004. Under the direction of scientist and division head Rajendra N. Basu, its primary areas of research focus are solid oxide fuel cells, lithium-ion batteries and mixed ionic- and electronic-conductor-based dense ceramic membranes for gas separation. Among the technologies that the division has developed or has under development include:

- Anode-supported SOFC single cells of dimensions 10 centimeters × 10 centimeters × 1.5 millimeters;
- Indigenous design and fabrication of grooved bipolar plates, cell holders and current collectors and associated gas manifolding systems for SOFC stacks;
- Production of glass-based sealants for SOFC stacks;
- Demonstration of working SOFC short stacks (up to 10 cells);
- Nanocrystalline ceria-based electrolyte for low-temperature SOFC application;
- Development of nanomaterials for use as lithium-ion battery cathodes and anodes; and

- Fabrication/testing of coin-type SOFC cells.

Another center of research is the Indian Institute of Science, where Bikram Basu is an associate professor at the Materials Research Center and an associate faculty member in the Bio-Engineering Program. In addition to his research activities, he has served as lead author of books on structural ceramics and tribology. Both were published in 2011 by John Wiley & Sons in association with The American Ceramic Society.

For the past decade, Basu has been engaged in research intended “to bridge the gap between materials science and biological sciences to develop new biomaterials and to emerge with a comprehensive understanding of cell–material interactions at various length scales.”

To date, the commercial potential of products developed as a result of his research has not been tested. “I have never tried to commercialize any of the products that have been developed in my laboratory,” he says. “Our research is mostly academic-oriented research, but I lately have been collaborating with other research institutes, such as R&D labs.”

Basu also is active in promoting increased interest in ceramics research in India and throughout the world. Since 2008, he has served as principal investigator of the Indo–US Science and Technology Forum-Funded Biomaterials Center and the UK–India Education and Research Initiative. He also has organized several international conferences held in India to promote the fields of biomaterials and nanoceramics.

Lalit Manocha, professor of materials science at Sardar Patel University, calls bioceramics an up-and-coming area of focus in India, where implants, stents and other medical devices are attracting research interest. “It only started a couple of years back, and there is great interest in that from government, from [academic] institutions and from industry,” he says.

Manocha continues, “Another area of R&D is high-performance ceramics, carbon oxide and composite materials. Professor Satish Manocha, who happens to be my wife, is working on solder processing of advanced ceramics and high-temperature ceramic foams. There’s
a lot of work that has been done on ceramic membranes, and we have industries manufacturing these membranes. The Ceramic Research Institute and National Institute for Interdisciplinary Science and Technology laboratories also have developed technologies for ceramic membranes. These are supported by government research and development programs. The technology has gone to industries that are producing ceramic membranes, which are being used for water purification. These water purification units are being supplied to the villages.”

Those partnerships reflect a high awareness of the value of knowledge sharing, Manocha adds. The Indian government, institutes and industry are all interested in opportunities for collaboration with other countries on research and development in advanced ceramics.

Traditional ceramics power export growth

All of this is in addition to expansion of whitewares, sanitarywares and wall and floor tile—areas of ceramics in which exports are on the rise. Organizers of Ceramics Asia 2012—which will be held December 13–15 at the Gujarat University Exhibition Center in Ahmedabad—note that India ranks third in the world in production and consumption of ceramic tile. According to the event’s website, India’s ceramic tile production volume grew more than 25 percent in 2009. In 2010, the country’s total ceramic production accounted for 6 percent of global output.

Lalit K. Sharma is the Central Glass & Ceramic Research Institute’s scientist in charge and chair of the Western Uttar Pradesh Chapter of the Indian Ceramic Society. He says the global market for Indian tile, including those of traditional handcrafted design, has been so great that Indian companies have opened showrooms in countries as distant as Australia and Canada. Sharma adds that India made its entry into this area of international trade by offering a quality and price advantage over Chinese products. However, the industry now is pursuing technological upgrades so that Indian companies are not forced to compete largely on price.

Manocha reinforces this point and notes that, for example, many Indian companies are collaborating with Italy to improve the glazes they use. “The tile industry in India is working at both ends—that is, economical tile as well as the advanced tile with good glazes and coatings,” he says. “[More than] 75 percent of Indian tile are exported to more than 70 countries, so there is a lot of effort going on in traditional ceramics for improvements.”

Overall, the industry’s prospects continue to evolve. Right now, the opportunities are in large part being driven by the steel or concrete/cement producing industries. Mohan says it will be some years before India will be prepared to commercialize most of the advanced ceramic research now underway. However, the country is making a significant commitment to engaging in that research now to establish a foundation for further expansion of the ceramics industry as India’s economic fortunes and commercial demands advance.
CALL FOR PAPERS  

ABSTRACT DUE NOVEMBER 4, 2012

The 10th Pacific Rim Conference on Ceramic and Glass Technology
including GOMD 2013 - Glass & Optical Materials Division Annual Meeting

June 2–7, 2013  |  Hotel Del Coronado  |  San Diego, CA, USA

Endorsed by: The Chinese Ceramic Society  |  The Korean Ceramic Society  |  The Ceramic Society of Japan  |  The Australian Ceramic Society
The Indian Ceramic Society  |  World Academy of Ceramics  |  The Brazilian Ceramic Society  |  The Thai Ceramics Society
The European Ceramic Society  |  Mexican Society of Materials

www.ceramics.org/pacrim10
A brief history and overview of The Indian Ceramic Society

The founding and growth of The Indian Ceramic Society have been profound.

The long cooperative history between InCerS and The American Ceramic Society—although they are separated by thousands of miles—is one that may be largely unknown to the worldwide ceramics community.

The concept of a society for Indian ceramists began to percolate as early as 1921 as documented in letters circulated by Sardar Krishan Singh. As a result, a fledgling group was formed.

Although the idea for a society did not soar immediately, it gained new life after T.W. Talwalkar visited the United States and learned about the success of AICerS. When he returned to India in 1927, he became a strong advocate for a similar type of organization in India. Talwalkar met with Singh and several others, including Sardar Dogar Singh and Mulkh Raj. Together, they reached out to others in the pottery, glass, enamel, ceramics, refractories and allied disciplines. They used the organizational structure and reach of AICerS as a model.

There were initial difficulties in generating a “critical mass” to launch a society. However, the above-mentioned forefathers—whose names are revered in InCerS like those of Edward Orton and Ross Purdy are within AICerS—and others coalesced personal and organizational commitments of support for a founding meeting. In a show of support, the India Glass Manufacturers Association agreed to hold one of its sessions at a concurrent time and location.

On April 15, 1928, a three-day inaugural meeting of The Indian Ceramic Society was held at Banaras Hindu University, located in Varanasi, Uttar Pradesh. Although only 26 people attended this first meeting, they represented ceramic interests from across the nation. The group also was buoyed by communications of support from 22 other ceramists. This group of 48 became the founding nexus of InCerS. Besides participating in the detailed work of establishing a formal organization, all participants were excited about elevating ceramic practices and profes-
Quickly, InCerS leaders targeted three key activities for the Society: start a journal; establish a central library and museum; and form a standing committee to advise universities about the professional and technical requirements needed by industry.

InCerS leaders also added to this list of duties the need to hold annual general and sectional meetings.

InCerS launched its first journal in 1928. Talwalkar was the initial editor.

The next decade, however, was a struggle for survival for InCerS while enthusiasm waxed and waned. Fortunately, a lifeline of support that would be crucial arrived with the creation of the Department of Ceramic Technology at Banaras Hindu University. Moreover, Pandit Madan Mohan Malaviya and N.N. Godbole provided important support for ceramics and the Society at BHU at Varanasi. The former is considered to be the main architect for establishing BHU, and the latter was the university’s pro-vice-chancellor at the time.

Fortunately, this new department at BHU flourished and did pioneering work with its sister Department of Glass Technology. The staff at BHU, especially H.N. Roy, relaunched the organization under the name “BHU–Indian Ceramic Society.” Roy agreed to take over the work of revitalizing the Society. In 1941, its official headquarters was transferred from Talwalkar’s residence in Jamshedpur to BHU. InCerS held its fifth annual meeting a few months later, an event attended by 94 members, which was a remarkable number for that time.

Besides the growing number of meeting attendees, InCerS received an important financial boost when several

Excel Colours & Frites Ltd.  
Website: www.excelcolours.com/  
E-mail: info@excelcolours.com  
Phone: +91-141-2771131  
Fax: +91-141-2770124  
Address: G-153-554, Sitapur Industrial Area, RIICO  
Tonk Road, Jaipur 302 022 (Rajasthan), India

Furnace Fabrica Ltd. (India)  
Website: www.furnacefabrica.com/  
E-mail: info@furnacefabrica.com  
Phone: +91-(022)-27612056  
Fax: +91-(022)-27612056  
Address: C-16/3, TTC, MIDC Area, Pawane, Thane-Belapur  
Road Navi-Mumbai 400 705, India

Hindustan Sanitaryware & Ind. Ltd.  
Website: www.hindwarehomes.com/  
E-mail: customercare@hindware.co.in  
Phone: +91-660 6677  
Address: HSIL Limited, 301-302, Park Centre, Sector 30, N H 8, Gurgaon 122 001, India

Hopewell Ceramics Ltd.  
Website: www.hopewellceramics.net/  
Contact: Mr. Swapan Guha /Chairman  
E-mail: contact@hopewellceramics.net  
Phone: +91-1423-224912  
Address: A-17, Manish Marg, Gandhi Path, Nemi Nagar, Vaishali Nagar, Jaipur-302021 (Rajasthan), India

Indo US MIM Tec  
Website: www.indo-mim.com/home.html  
Headquarters & MIM Operations:  
E-mail: info@indo-mim.com  
Phone: +91 80 2204 8800/2797 1416/2797 1416  
Fax: +91 80 2797 1624  
Address: No 45, (P) KADBS Industrial Area, Hoskote, Bangalore 562 114, India

Indo-MIM is a leading global supplier of metal injection molded products and is a fully integrated MIM parts producer with capabilities and proficiency in design, tooling, materials and a full range of finishing and assembly operations.

Kailash Marketing Associates  
Website: www.kailashmarketing.co.in  
Contact: B. P. Viswanathan  
E-mail: contact@kailashmarketing.co.in  
Phone: +91-98204 06556  
Fax: +91-(22)-2757 6753  
Address: 48, H & G House, Plot No. 12, Sector 11, Jawa-  
harli Nehru Marg, CBD Belapur, Navi Mumbai 400 614 (Maharashtra), India

Kerala Clays & Ceramics Products Ltd.  
Website: http://keralaclays.in  
E-mail: kerala_clays@bSNi.in  
Phone: 0479-2787817, 2787281  
Address: Pappinsonery, Kannur 670 561, India

Mayur Chemical Industries  
Website: www.mayurchemicals.com/  
Contacts: Nirav Shah and Mayur Shah  
E-mail: marketing@mayurchemicals.com  
Phone: +91-22 277132 / 133 / 134  
Fax: +91-22 277135  
Address: 2/2, Shi Arhatant Compound, Than Bhivandi  
Road, Kalher Village, District Thane 421 302, India

Launched at a single desk in 1981, Mayur Chemical Industries has grown to become one of India’s largest chemical trading firms. It deals in raw materials, solvents, intermediates, API and other related products to create customized solutions for clients in the pharmaceutical, food, cosmetic, textile and paint industries.

Promis Industries  
Website: www.promisindustries.com/  
Contact: D. K. Purandare  
E-mail: info@promisindia.com  
Phone: +91-657-3292617  
Address: B-27, Phase-III, Adityapur Industrial Area  
An ISO: 9001-2008 accredited company, Promis is one of India’s largest manufacturers of Alkyd Resin in India and manufactures premium quality phenol formaldehyde resin (NOVOLAC and RESOL) for the refractory and foundry industries. The company’s phenol formaldehyde resins for refractory applications include resins for magnesium-carbon bricks, blast furnace tap-hole mass, blast furnace trough mass, and slide gate refractories as well as thermo setting PF resins powders. For foundry applications, its products include a two-part phenolic no-bake binder, Novolac resin for shell molding; Pepset Resin System, cold box resin system, and furan resin system.
members, including Talwalkar, stepped forward to offer payment for “life membership” in the organization. These funds created a valuable endowment for the Society to achieve its goals of maintaining a journal and setting up a library. Indeed, the group launched the library in 1942 at its offices in BHU.

In 1947, BHU made a generous donation to the Society that allowed the construction of a new building for the group’s library and museum, which continue in operation today.

An important event helped IncerS establish itself in the minds of its members and the broader scientific community. In 1943, the government of India proposed the creation of a national glass research institute. Talwalkar and others within the Society launched an effort to convince the government to instead create a “silicate research institute” that would encompass all branches of pottery, enamel, cement, refractories and glass. They and H.K. Mitra drew up plans for a Ceramic Research Institute that would be located in Calcutta, a site that would place it close to key industries and universities. The government’s Board of Scientific and Industrial research approved Talwalkar and Mitra’s proposal after considerable lobbying for the concept. Thereafter, the Board facilitated the launching of the Central Glass & Ceramic Research Institute at Calcutta (now Kolkata) in 1950. Society leaders shifted the headquarters of IncerS to CG&CR in 1958.

IncerS continued a sure and steady growth in the subsequent years. Annual meetings have been held uninterrupted since 1941. The Society celebrated its Silver Jubilee in 1953 and its Golden Jubilee in 1978. The latter was attended by then prime minister of India, Shri Morarji Desai.

In 2011, InCerS celebrated its Platinum Jubilee, a huge event that honored two luminary leaders within ACerS: Mrityunjay Singh and Arun Varshneya.

Several other important events are worth noting with regard to the history of IncerS.

In 1975, IncerS wanted to leave its stamp on the growing ceramic education establishment in the nation and, therefore, helped in the birth of the Indian Institute of Ceramics. The Institute was launched to fill the pressing need for adequately trained and certified ceramic personnel for employment in industry and R&D settings. The immediate goal of the IIC was to establish criteria for degrees in ceramics technology and testing for associate membership in the academic institute.

India ceramics directory and profiles, continued
After a few short-lived publishing attempts during its earliest years, InCerS launched its current technical journal, Transactions of the Indian Ceramic Society, in 1941. Transactions is currently published quarterly from InCerS headquarters, and it maintains an international editorial board. Transactions began to receive coverage in Thompson Reuters’ Science Citation Index beginning in 2007.

As ACerS did for the United States, InCerS has opened opportunities to a galaxy of ceramic scientists, technologists and industrialists in India to share their experiences and mutual understandings. Today, the organization has more than 2,000 members, including foreign members, who benefit from access to its periodicals and books, meetings and exposion, and special technical information. Like ACerS, the members of InCerS comprise a wide variety of individuals and interest groups that include scientists, engineers, researchers, manufacturers, plant personnel, educators, students, marketing and sales professionals, and others in related materials disciplines.

InCerS believes that its efforts, combined with those of the IIC and the CG&CRI, have made a major difference in the progress of the ceramics industry in India.

The ties between InCerS and ACerS go back 90 years, and warm and cooperative ties continue. Therefore, the two organizations have recently completed a formal collaborative agreement that includes

- Exchange of complimentary memberships for the executive leaderships of InCerS and ACerS;
- Special discount electronic ACerS membership for current InCerS members, which will provide online access to ACerS services, publications, directories and listings, plus discounts on ACerS books and other publications;
- ACerS membership in InCerS at a membership fee one-half of the normal annual amount;
- Exchange of technical articles and reporting on broad topics in ceramics and glass between ACerS’s Bulletin and Ceramic Tech Today blog and InCerS’s Transactions;
- Exchange and posting of topical and timely information on each other’s websites.

IMMT: Institute of Minerals and Materials Technology-CSIR
Website: www.immt.res.in
E-mail: dir@immt.res.in
Contact directory: www.immt.res.in/contact.php
Research Council directory: www.immt.res.in/rc.php
Management Council directory: www.immt.res.in/mc.php
Phone: +91-674-256-7126
Fax: +91-674-2567160
Address: Council of Scientific & Industrial Research, Bhubaneswar 751 013 (Odisha), India

IMMT “specializes in providing R&D support for process development with special emphasis on conservation and sustainable utilization of natural resources.” Its science and technology expertise spans diverse areas, from mineralogy to materials engineering, and the laboratory has explored mining and mineral/
bimetallic processing, metal extraction and materials characterization, process engineering, industrial waste management, pollution monitoring and control, marine and forest products development, utilization of medicinal and aromatic plants and appropriate technologies for societal development. The Advanced Materials Department "has designed and developed extended transferred arc plasma reactors for melting, smelting, carbo-synthesis etc. and extended non-transferred arc-in-flight plasma reactor for dissociation of minerals, spheroidization of materials." Areas of research listed on its website include thermal and RF plasma synthesis of structural and advanced ceramics; preparation and characterization of fine and ultra fine powders; smelting reduction, composite materials; and ceramic slurry processing, gel casting and direct coagulation casting waste utilization.

Dalma Institute of Scientific & Industrial Research
Website: www.dalmainstitute.in
E-mail: info@dalmainstitute.in
Phone: +91-6624-211536
Fax: +91-6624-220933
Address: Dist-Sundargarh (Odisha), India

The Dalma Institute of Scientific & Industrial Research conducts fundamental and industrial research in refractory, cement and waste utilization on a contract basis. Refractory research includes silica refractories, high-alumina, magnesia, magnesia-chrome, magnesia-carbon, alumina-carbon, alumina-magnesia-carbon qualities. Cement research includes development of Portland and high-alumina cement. Waste utilization includes sponge iron waste and other industrial wastes. Fundamental research includes development of nanometric oxides.

Dayalbagh Educational Institute
Website: www.dei.ac.in
E-mail: admin@dei.ac.in
Phone: 0562-2801545
Fax: 0562-2801226
Address: Dayalbagh, Agra 282 005 (Uttar Pradesh), India

Indian Institute of Chemical Technology
Website: www.iict.res.in
Contact: Ahmed Kamal, Acting Director
E-mail: ahmedkamal@iict.res.in
Phone: +91-40-27160387
Fax: +91-40-27160387

Indian Institute of Science (Bangalore)
Website: www.iisc.ernet.in/index.php
Contact: P. Balaram, Director
Phone: +91-28016092/222
Departmental phone and email directory: www.iisc.ernet.in/quicklinks/tel_dir/admteldir.php
Mailing address: The Registrar, Indian Institute of Science, Bangalore 560 012, India

Indian Institute of Technology (Bombay)
Website: www.iitb.ac.in/departments.html
Email: prof@iitb.ac.in
Contact directory: www.iitb.ac.in/about/contact_iitb.html
Phone: +91-22-2576-0726
Fax: +91-22-2576-0727
Address: Powai, Mumbai 400 076 (Maharashtra), India

The Indian Institute of Technology, Bombay has developed an engineering curriculum that emphasizes the study of mathematics, physics and chemistry in addition to engineering. The curriculum also provides students with exposure to economics, English, philosophy and social sciences to give them a sense of the needs of the larger society beyond the world of engineering. The Department of Metallurgical Engineering and Materials Science describes its mission as "to develop and disseminate understanding of Structure-Property-Processing-Performance relationships for engineering materials through instruction and research." Its areas of focus encompass the design, creation and fundamental understanding of "materials that are capable of enhancing the human experience." Departmental research covers such materials as metals, polymers, ceramics, glasses, electronic materials, biomaterials and composites.

Indian Institute of Technology Madras
Website: www.iitm.ac.in
Phone: +91 (44) 2257 0509
Address: Indian Institute of Technology Madras I.I.T. Post Office, Chennai 600 036, India

Indian Institute of Technology Delhi
Website: www.iitd.ac.in
Fax: +91 011-2659 1999, +91 011-2659 7135
Fax: +91 011-2658 2037, +91 011-2658 2277
E-mail: webmaster@admin.iitd.ac.in
Address: Hauz Khas, New Delhi 110 016, India

Indian Institute of Technology Kanpur
Website: www.iitk.ac.in
Fax and phone email directory: www.iitk.ac.in/infocell/iitk/newhtml/contactus.htm

Indian Institute of Technology Karagpur
Website: www.iitkgp.ac.in

NIIST: National Institute for Interdisciplinary Science and Technology-CSIR
Webmail: www.niist.res.in/english/
E-mail: director@niist.res.in
Phone: +91-471 – 2491712 / 2491585
Fax: +91-471 – 2491882
Address: Thrivunanthapuram 695 019 (Kerala), India

NIIST engages in research and development activities in basic and applied research on advanced ceramics for structural and functional applications; sol-gel synthesis of ceramic precursors for nano-particles; coatings/membranes; catalysts; and ceramic fabrication. The organization's website lists its areas of focus in materials science and technology research and development as:
• Basic and applied research on advanced ceramics for structural and functional applications
• Sol-gel synthesis of ceramic precursors for nano-particles, coatings/membranes and catalysts
• Developmental work in the area of high Tc superconductivity, electronic ceramics and ceramics for communication
• Exploitation and value addition of renewable and non-renewable material resources and mineral based technologies
• Development of new light alloys and their metal matrix composites for strategic as well societal needs
• Development of novel ceramic oxide materials
• Microstructure and microchemical analysis of materials using electron microscopy.

PSG College of Technology - Coimbatore
Website: www.psgtech.edu
Contact: R. Rudramoorthy, Principal
E-mail: principal@psgtech.ac.in
Phone: +91 422-2572177, 2572477, 2580455, 2578455, 4344777
Fax: +91-422-2573033
Address: Post Box: No. 1611, Peelamedu, Coimbatore 641 004 (Tamil Nadu), India

Samrat Ashok Technological Institute
Website: www.satiet.org
Email: ati@satiet.org
Phone: 07592-250296, 250297
Fax: 07592-250124
Address: Netaji Subhash Marg,Civil Lines, Vidisha, Madhya Pradesh 464 001, India

Sardar Patel University
Website: www.spovun.edu
Contact: Harish Patli, Vice Chancellor
E-mail: mpratel14679@gmail.com
Phone: (02692) 226814
Address: Sardar Patel University, Vallabh Vidyanagar 388 120 (Gujarat), India

University of Hyderabad
Website: www.uohyd.ac.in
Contact: Ramakrishna Ramaswamy, Vice-Chancellor
E-mail: vcl@uohyd.ernet.in
Phone: 23132000 / 2301012
Address: Prof. C.R Rao Road, P.O. Central University, Hyderabad - 500 046, A.P, India

PROFESSIONAL ASSOCIATIONS
The Indian Ceramic Society
Website: www.icers.org
Contact: A. L. Shashi Mohan, President
E-mail: vipra@vsnl.net
Phone: (080) 26647696 / 26364862 / (080) 26596634 / 9448468642
Address: 164/A, 24th Cross 6th Block, Jayanagar Bangalore 560 082 (Karnataka), India

InCerS membership exceeds 2,000 scientists, engineers, researchers, manufacturers, plant personnel, educators, students, marketing and sales professionals and others in related materials disciplines. Included in the total are some members based in other countries. The association provides members and subscribers with access to periodicals and books, meetings and expositions and technical information.

Indian Council of Ceramic Tiles and Sanitaryware
Website: www.icctas.com
E-mail: info@icctas.com
Phone: +91-11-26964238
Fax: +91-11-26511385
Address: 4th Floor, PHD House, 4/2 Siri Institutional Area, August Kranti Marg, New Delhi 110 016, India

Federation Of Ceramic Industries
Website: www.ceramicointernational.org
Contact: Sushil Bhalla, President
Phone: +91-2751-222146
Anchor Sanitaryware Pvt. Ltd.
Address: Tarntar Road, Thane (W), Mumbai, Maharashtra, India