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The Missing Link

Ceralink Inc. is fostering developments in materials science by

connecting manufacturers with practical microwave processing solutions.

by **Christine L. Grahl**, Editor

While everyone likes to read and hear about new and emerging technologies, most companies in today's resource-strapped economy don't have the time and/or money required to really pursue innovative technologies for themselves. This is especially true of equipment perceived as "experimental," such as microwave processing systems. Such systems have often been touted over the past decade as a way to save energy, increase productivity and improve product quality—but many of those claims have been made by researchers outside of the manufacturing arena, and case studies of proven benefits in ceramic and glass manufacturing plants are often hard to find. In-depth, customized testing can be expensive, and positive results aren't guaranteed. Given all of these challenges, it's no surprise that many companies reject the idea of microwave processing without more than a cursory glance.

According to Holly Shulman, Ph.D., president of the Alfred, N.Y.-based Ceralink Inc., such attitudes are understandable. As a materials scientist with a background in ceramics and glass, Shulman observed and studied microwave processing for a number of years with a high level of skepticism.

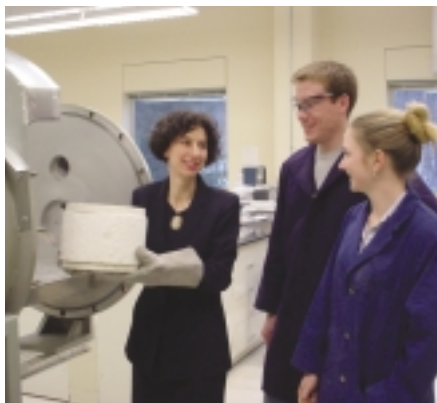
"There was general knowledge of microwave heating in the ceramic and

glass industry, but for the longest time it was just considered a far-off idea studied by universities and national laboratories. I remember thinking that the technology didn't work, but that if it did, it would be really important to the industry," she explains.

Then, in the late '90s, Shulman began to see that changes were taking place that could pull microwave processing into the commercial realm. Researchers worked out some of the early problems, such as "hot spots," and suppliers began offering lower-cost units that were capable of providing uniform heating on a production scale. After an in-depth study of published research and some hands-on experience at

Industrial Research Ltd., a New Zealand Crown Research Institute, as well as collaboration with the faculty at the University of Wollongong, NSW, Australia, Shulman became convinced that microwave technology offered practical benefits in industrial processes. In January 2000, Shulman established Ceralink Inc. to foster an understanding and commercialization of microwave and other useful technologies by bridging the disconnect that often exists between the manufacturing industry, suppliers and breakthroughs in research.

"I saw that microwave processing would be useful on many fronts, but there wasn't a clear vehicle for bringing it from the successful laboratory stage into industry. I believed that large-scale commercialization of microwave heating was inevitable, but would be slow, and that Ceralink could take an active role in driving this technology forward by facilitating industrial successes," Shulman says. "An important element for any research to become a valuable industrial technology is the addition of good engineering practices. This requires an understanding of the relative size of the business opportunity to the cost of implementation. Ceralink's objective is to offer ceramic and glass manufacturers effective, practical manufacturing solutions in materials science. We are working with microwave technology because it is ready for implementation."



Holly Shulman, President, sets up microwave feasibility study in CPI Autowave



The Ceralink team—clockwise from left: Morgana Fall, ceramic engineer; Patricia Strickland, COO/business manager; Kelly Kingston, office assistant; Gabrielle Gaustad, student; Holly Shulman, Ph.D., founder and president.



Engineering students gain microwave processing training at Ceralink

Breaking Down the Barriers

According to Shulman, modern microwave systems have been proven to work successfully for a variety of ceramic, glass and metal products. In fact, a number of companies are already using microwave furnaces for applications such as tungsten carbide and silicon nitride sintering, glass forming, and binder burnout—and are achieving significant product quality and productivity benefits as a result. Often, however, these companies view their use of microwave technology as a trade secret to be guarded carefully.

“Microwave processing is being used successfully in many different heating

applications in the ceramic industry, and is extensively used in drying. However, companies have not wanted to share that information because it has been a competitive advantage,” says Shulman. “As a result, many other companies still perceive microwave to be primarily an ‘R&D technology,’ but that perception is changing. Eventually, microwave binder burnout, calcination, glass forming, sintering, etc., will be recognized as industrial standards, just as microwave has been accepted in other industries, such as the chemical industry, where it is the standard digestion method for trace element analysis.”

Shulman says that another significant barrier to the widespread use of microwave technologies is the enormous expense involved in application-specific research and testing. “Companies have to dabble in the technology first before they invest in purchasing a microwave dryer or furnace for their plant, and the learning curve is steep since most ceramic and glass manufacturers don’t have in-house microwave expertise or a research microwave system. They need to find out if the technology is going to work for their process, what kind of energy savings and productivity improvements to expect, and whether there are any product quality benefits. A reasonable study might cost upwards of \$100,000, and might actually indicate that the technology doesn’t work for that particular application. No one wants to invest that much in a dead end,” she says.

Ceralink is striving to eliminate these barriers by providing objective information about microwave processes, as well as cost-effective ways to determine the feasibility of new technologies. The company has hands-on experience with microwave processing of many types of materials, including ceramics, glass and metals. Its 1000-square-foot lab contains microwave equipment that can be used in air, inert or reducing atmospheres to temperatures in excess of 2000°C, and it also has easy access to analytical equipment at Alfred University, which is located just one mile away.

“We’re helping companies understand new technologies and explore new

processes before committing a significant investment in development and scale-up,” explains Shulman. “They tell us what they’re hoping to accomplish, and we use our expertise and extensive network of contacts to advise them and guide them. We can provide low-cost feasibility studies that can help them justify further spending if the results are positive—or, conversely, can keep them from wasting money on R&D that doesn’t look positive. Our goal is to create new wealth for manufacturers.”

Expanding the Network

Ceralink’s services aren’t limited to research, testing and scale-up assistance. In fact, one of the company’s key strengths lies in a system of linkages and collaboration—called Ceralinking—which is designed to bring together the physical and human resources needed for complex projects. If the necessary expertise for a given project isn’t available within Ceralink, the company can recruit assistance from one of its numerous industry or university contacts. The company will also act as a “matchmaker” to bring partners together for research and scale-up projects. For manufacturers that decide to pursue an investment in microwave processing equipment, Ceralink can help them identify and work with a microwave furnace supplier. However, Shulman is quick to point out that Ceralink’s relationship with equipment suppliers is as a demanding, knowledgeable customer, not as a sales representative.

“We’re interested in finding the best solution for the ceramic or glass manufacturer—their success is what will fund the uptake of microwave technology, which is to everyone’s benefit,” she says. “We objectively evaluate different types of equipment and different resources, and then provide our recommendations based on what we know about their project. We also feed general information back to suppliers regarding the needs of different industrial processes so that they can continue to improve their technologies and services.”

While the Ceralinking process is primarily focused on providing solutions to

manufacturers, it also offers far-reaching benefits to suppliers and universities, and therefore to the industry as a whole. As manufacturers implement more microwave technologies, suppliers are able to expand their own research and development efforts and provide improved systems for industrial applications. Likewise, as universities and national labs continue to develop intellectual property and know-how, they're able to have more research funded through licensing and partnering with industry. As a result, manufacturers looking for microwave solutions have access to an increasingly broad range of experienced, knowledgeable resources.

"The work we do here really comes about full circle. The more people that contact us for solutions, the more solutions we'll be able to offer," says Shulman. "We have a nice pool of resources that is constantly growing."

Ceralink's network has grown in another important way as well. The company works with a number of students from Alfred University through co-ops and internships, and has also employed some students in part-time positions. In addition to helping keep R&D costs down, working with students fosters a new generation of engineers and materials scientists who are highly trained in practical, industry-oriented microwave processes. When these students enter the workforce, they will undoubtedly continue to help advance microwave processing technologies.

Filling a Need

Although Shulman is a big proponent of microwave technologies, she says that Ceralink's goal isn't to try to force change within the industry. Rather, it's to facilitate the change that is already taking place.



Silicon carbide discs in a microwave furnace.



Jeff Miller, Ceralink engineer, peers through an optical pyrometer as materials heat up in the microwave.

"The idea is not to force something down somebody's throat—we're not coming out with a product and saying, 'Buy this.' Instead, we really have looked into what the industry needs and how we can help them find solutions to those needs. Energy costs and time bottlenecks are serious problems in the manufacture of ceramic and glass products. We think microwave processing is one solution, and it's clear that many manufacturers are beginning to implement these technologies," she explains.

The company offers a private R&D setting that manufacturers can turn to for microwave testing, contract research, materials characterization, process development, scale-up assistance and technology transfer. Additionally, its network of external resources is constantly expanding. As the company moves forward, Shulman expects to see growth through joint ventures and spin-offs relating to microwave processing and other technologies. She also hopes to be able to work on an increasing number of projects that benefit the environment—whether through enhanced energy efficiency in manufacturing, or through new technologies such as fuel cells that offer a range of benefits on a broad scale. But most important to Shulman is the human factor.

"I earnestly believe that people are important—worthy of respect, kindness, and personal success. When you treat people this way and help them focus on their technical problem/opportunity, the solutions come as a natural part of the collaborative process," she says. "We have a strong network because we really care; people like to work with us. It makes sense to design a service based on this strength, and our innovative engineering abilities. We have defined 'success' as helping our clients make money, and we have already received validation that Ceralink is needed here." 🌐

For more information about Ceralink and/or microwave processing technologies, contact the company at 200 N. Main St., Alfred, NY 14802; (607) 587-9816; fax (607) 587-9535; e-mail info@ceralink.com; or visit www.ceralink.com.

For Further Reading

Shulman, Holly, "Microwaves in High-Temperature Processes," *Industrial Heating*, March 2003.

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