

Ceramic & Glass

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MANUFACTURING

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BREAKING DOWN BARRIERS TO INNOVATION: HOW TO KEEP GROWING IN THE FACE OF NEW CHALLENGES

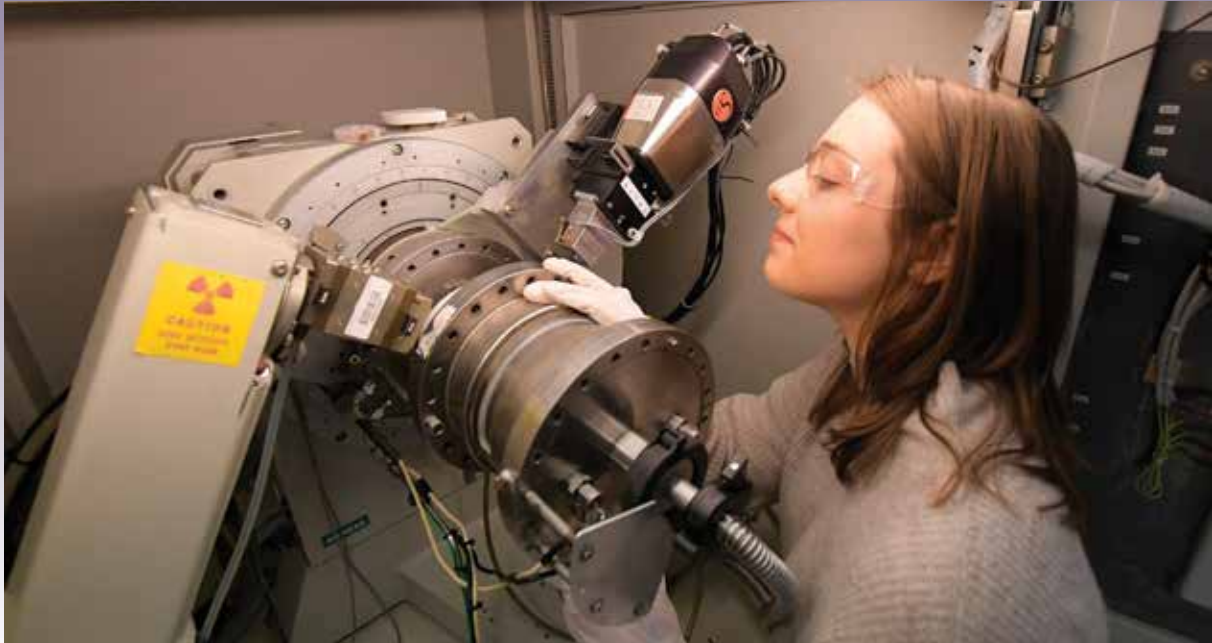
US MANUFACTURING ECOSYSTEM KEY TO ECONOMIC GROWTH, INNOVATION, COMPETITIVENESS

FOR STEVANATO GROUP, YEARS OF INNOVATION HAVE PAID OFF



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INDUSTRY NEWS

ARDAGH BEGINS ONSITE SOLAR POWER PROJECTS

Ardagh Group S.A. started construction of three solar projects in the Netherlands. The installations will supply renewable, onsite-generated electricity to Ardagh's Dongen, Moerdijk, and Oss facilities and are part of the company's strategy to use 100% renewable electricity by 2030. The Netherlands is the first country where Ardagh will supply all its production facilities with onsite-generated energy via large-scale solar installations. The company says its overall strategy is built on a combination of onsite, near-site, and offsite renewable electricity projects.

In Europe, Ardagh plans to replace 14,500 MWh of electricity consumption from the grid.



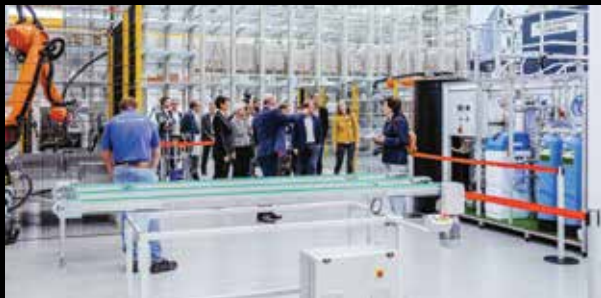
CerAMing holds numerous patents around the layer-wise slurry deposition printing process.

LITHOZ ACQUIRES GERMAN 3D-PRINTING STARTUP CERAMING

Lithoz GmbH announced the acquisition of Germany-based CerAMing, the patent holder of the layer-wise slurry deposition ceramic 3D printing process. Founded in 2019 in Berlin, CerAMing is a spinoff of the Federal Institute for Materials Research and Testing. With the acquisition, Lithoz says it now has a complete "all-from-one-source portfolio" of complementary, market-relevant processes in 3D printing for advanced ceramics.

SOLAR FAÇADE PANEL PLANT OPENS IN GERMANY

Envelon opened a solar panel production facility at the headquarters of the Grenzebach Group in the Bavarian town of Hamlar, Germany. Envelon has been part of the Grenzebach Group, which has more than 20 years of experience producing photovoltaic systems, since 2021. The company says the facility has solar façade panel production capacity of up to 300,000 square meters per year and will help the company meet significant demand from China and the United States. Envelon is a supplier of photovoltaic façades and building envelopes.



Grenzebach is consolidating production of Envelon photovoltaic building façades in Hamlar, Germany.

Orora has a goal of 60% recycled content for glass beverage containers by 2025.

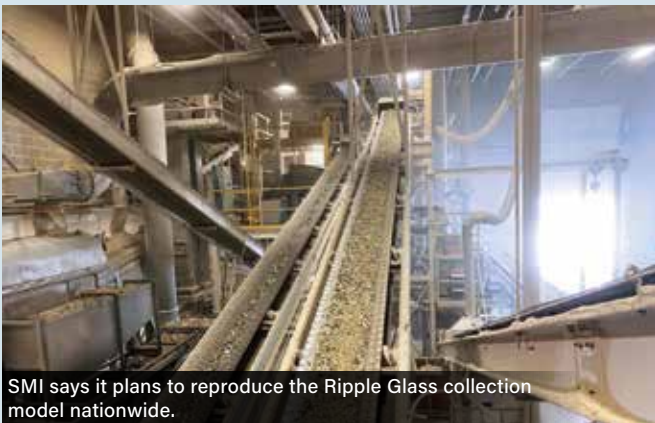


ORORA OPENS \$25M GLASS RECYCLING PLANT

Glass packaging provider Orora began operating a new \$25 million glass beneficiation plant in South Australia that will significantly increase the recycled content in its manufactured glass products. Construction was supported by \$8 million in grant funding from the Australian government. The plant has the capacity to produce a maximum of 150,000 tonnes of furnace-ready, recycled glass each year, with 100% of it to be used by Orora to produce glass packaging for its customers across the beverage industry.

STRATEGIC MATERIALS ACQUIRES GLASS RECYCLER

Strategic Materials, Inc. announced it acquired Kansas City, Mo.-based Ripple Glass. SMI says the acquisition will accelerate its plan to expand glass collection programs and increase glass recovery rates across North America. All Ripple Glass employees were retained by the company. SMI says it is North America's largest glass recycler, with nearly 50 locations in the United States, Canada, and Mexico. Ripple Glass, founded in 2009, provides passive solutions for post-consumer and post-industrial glass throughout the Midwest and operates a glass processing facility in Kansas City.



SMI says it plans to reproduce the Ripple Glass collection model nationwide.

Schott reduced its carbon emissions despite an increase in energy consumption.



SCHOTT REACHES MILESTONES IN GREEN ENERGY PLAN

Specialty glass manufacturer Schott says it achieved the first milestones in its plan to become a climate neutral producer by 2030, by switching to 100% green electricity and making a 60% reduction in carbon emissions. Schott says it relies on renewable energies purchased through independently verified green electricity certificates and on power purchase agreements, which are contracts with operators of renewable energy plants, such as wind farms. "We are investing a mid-double-digit million-euro amount to achieve our climate targets," says Jens Schulte, head of Schott's zero carbon program.

RWE AGREES TO BUY CON EDISON CLEAN ENERGY UNIT

RWE AG signed a purchase agreement with Con Edison, Inc. to acquire all shares in Con Edison Clean Energy Businesses, Inc. The purchase will include 3 gigawatts of operating capacity and a development pipeline of more than 7 GW. The companies say they agreed on a purchase price of \$6.8 billion. When completed, the purchase will make RWE the second-largest solar operator in the United States. Germany-based RWE says it has earmarked up to 15 billion euro for investment in the U.S. as part of its growth strategy there.



RWE has a project pipeline of more than 24 GW in onshore wind, solar, and batteries in the U.S.

Saint-Gobain wants to reduce its direct and indirect carbon dioxide emissions by 33% by 2030.



SAINT-GOBAIN CO₂ REDUCTION TARGETS GAIN INDEPENDENT APPROVAL

Saint-Gobain says the Science Based Targets initiative approved its greenhouse gas emission reduction targets, confirming they are consistent with the organization's net-zero standard and the Paris Climate Agreement. The Science Based Targets initiative is a collaboration of CDP Worldwide, the United Nations, the World Resource Institute, and the World Wildlife Fund that independently evaluates corporate targets for transitioning to a low-carbon economy. Saint-Gobain says it is the first company in its sector worldwide to receive the approval since the standard was introduced at the end of last year.

BREAKING DOWN BARRIERS TO INNOVATION: HOW TO KEEP GROWING IN THE FACE OF NEW CHALLENGES

By David Holthaus



Saint-Gobain engineers developed durable ceramic rollers to reduce downtime in the hot-stamping process. *Credit: Saint-Gobain*

Innovation is essential for manufacturers to grow market share, develop new products, improve efficiency, and increase revenue and profits. But given the economic conditions of our time, fostering and maintaining a culture of innovation can get lost in the crush of meeting day-to-day operational challenges.

A global pandemic, supply chain disruptions, a labor shortage, and inflationary cost increases have converged to make the operating environment difficult, with the risk that developing new products and new technologies may become lesser priorities.

So how does a manufacturer keep growing, changing, and innovating in the face of these pressures? It begins with staying close to the customer.

"It starts with customer discovery, listening, and being empathetic," says Brandon Cornuke. "There's opportunity there."

Cornuke is vice president of strategy and innovation at Cleveland-based Magnet, part of the National Institute of Standards and Technology's Manufacturing Extension Partnership. He consults with

manufacturers, entrepreneurs, and other organizations to help bring new ideas to fruition.

Innovation, he says, is a catch-all term that can lose its meaning, but at its root, it is about creating new value by constantly solving problems that move the business forward. It usually does not involve world-changing ideas but incremental changes that lead to growth. That starts with connecting with the customer.

"You really have to find ways to solve problems for your customers," he says. "Any customer segment that has a problem should be someone you can focus on and do your best to listen to."

That is how the product development process starts at Superior Technical Ceramics. Based in St. Albans, Vermont, privately owned STC has been in the ceramic materials business since 1898. As a small manufacturer, it prides itself on customer service and technical innovation.

Research and development at STC begins with "sitting down with our customers and talking about what direction they see their com-

panies going and what they need from us," says Kelleen Loewen, vice president of sales and marketing at STC. That could be new shapes, new products, or new technologies.

"You have to listen to find out what's coming down the pipeline," she says.

The same holds true at big manufacturers. Saint-Gobain is a 44-billion-euro company that employs more than 166,000 people around the world. It operates eight research centers globally, where engineers are responsible for about 400 patents a year.

"Innovation is central to everything we do as a company," says Adam Stevenson, director of research for specialty grains and powders at Saint-Gobain's North American research and development hub in Northborough, Mass. "The biggest key to having a good innovation program is working very closely with your customers."

That is where Saint-Gobain's development work begins.

"The more you can be hand-in-hand with your customers, understanding their problems, understanding their pain points, and understanding the directions they want to go, then you can develop the R&D programs that answer those problems," Stevenson says.

An example is the company's work with automobile manufacturers who are striving to make lighter-weight vehicles, particularly for the electric vehicle market. Hot stamping emerged as a manufacturing process for the vehicle frame and can result in lightweight steel that retains its durability and strength. However, the hot stamping process can result in contamination and damage to the ceramic rollers that convey the steel through the process, and that can cause production downtime.

Working with the auto manufacturers and Tier 1 suppliers, Saint-Gobain engineers developed specialty rollers that mitigate contamination and weakening, allowing for significantly longer lifetimes in the furnaces and fewer problems in the hot-stamping operation, Stevenson says.

That is the kind of innovation that falls under the category of "near-in" or incremental innovation—making something a little better or a little faster.

"That is the majority of what organizations do, about 70% of the time," Cornuke says.

He adds that about 20% of innovation falls in the second tier—finding a new market for a product, or delivering a product differently or more efficiently. The final 10% of innovations typically have a much longer horizon—new customers, new products, new sales channels.

Saint-Gobain has a team of engineers and material scientists dedicated to projects in that final category, termed "Horizon 3 projects," which may not produce results for five to 10 years, Stevenson says.

"These are high risk-reward efforts," he says. "These are megatrends you want to hitch yourself to, but there's a huge amount of transition risk."

Indeed, that is the top barrier to innovation in Cornuke's experience, particularly among manufacturers that do not have the huge R&D budget that a company the size of Saint-Gobain does.

"The number one barrier among small manufacturers we work with is aversion to risk," he says. "They have people on the payroll and products to get out the door. Taking a risk is hard for them to do."

For the last two to three years, STC has been producing at its capacity, spending most of its time managing orders from current customers, Loewen says. But in 2023, it will focus on where it can find production capacity it can fill and assess potential customers for that work. The sales and marketing team will work closely with the manufacturing side to assess sales inventory and operations, planning budgets, and determining where there is room to grow, she says.

The company also made a recent acquisition that provided additional capacity. At the end of 2020, it closed on the purchase of Santa, Ana-Calif.-based IJ Research, a manufacturer specializing in sapphire-to-metal brazed hermetic assemblies. STC will look to expand the markets of that division, Loewen says.



Brandon Cornuke

Even large manufacturers can be averse to the risks of innovation. It is the major barrier internally to innovation at Saint-Gobain, Stevenson says.

"Anytime you enter into a major development program, there's a risk-reward that you have to balance," he says. "You have to find ways to reduce the risk or make sure the business has the tolerance."

That tolerance can begin with leadership that values risk-taking and makes it part of a corporate culture, Cornuke says.

"It helps to have a leader who supports risk taking with smart steps and smart investment," he says. "You can't succeed if you don't have a leader who says we're going to support risk-taking and we're not going to crucify people who don't succeed."

Accepting, even celebrating, failure should be part of the culture, he says.

"That's anathema to small organizations, or really any organization," he says. "You have to find a way to say we tried this and we learned."

Saint-Gobain's advanced ceramic materials division serves markets including aerospace, automotive, energy, and semiconductors.
Credit: Saint-Gobain



Other barriers to innovation include finding labor and talent.

"It's very hard to find engineers and technical people," Loewen says. "It seems all of these people were around four or five years ago, but they're nowhere to be found now."

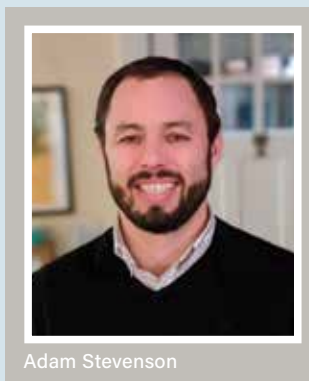
Supply chain constraints are slowing innovation as well. Some manufacturers are asking their customers to order much farther in advance, and many are "reshoring" their suppliers domestically to shorten the supply chain.

A Bank of America survey of 3,000 companies found that the COVID-19 pandemic accelerated a shift in manufacturing to the U.S. and Europe and away from China. Seventy-five percent of the respondents said they were reshoring operations to their home bases or to neighboring countries. However, that is not always possible, and doing so can be costly. Bank of America projected that shifting production that is not meant for China out of China would cost \$1 trillion over five years.

Innovation also requires constant assessment of the dynamics of the economy to spot where new opportunities may lie. STC, for example, is looking to grow its business among oil and gas producers as the rising cost of energy is expected to stimulate production. A huge market for ceramic manufacturers—aerospace—was down in 2020 and 2021 as the pandemic hampered travel, but the sector has

rebounded, and jet engine manufacturers are expected to ramp up production. GE Aerospace, for example, one of the world's biggest jet engine makers, recently reported a 24% increase in its third quarter revenue from a year ago.

Other industries ripe for innovation include anything to do with the hydrogen economy, semiconductors, electric vehicle batteries, and businesses in human health and security, such as antimicrobial surfaces, Stevenson says.



Adam Stevenson

The long-term move toward the decarbonization of industry is another trend that will demand innovation.

"There's a massive number of industrial processes that will need ancillary changes," Stevenson says.

He points out that research and development is just one part of the innovation system. Sales and marketing and purchasing are critical cogs in the innovation machine too, as they understand what the internal and external customer needs are.

Innovation requires doing new things and doing things differently, and the path can be full of obstacles.

"Innovation is a messy process," Stevenson says. "You fundamentally have to accept failure along the way. There's a lot of behaviors that you have to build into an innovative culture. One of them is understanding that it's a messy process. But ultimately it's exceptionally rewarding." ▀

US MANUFACTURING ECOSYSTEM KEY TO ECONOMIC GROWTH, INNOVATION, COMPETITIVENESS

By Devon Bistarkey

Devon Bistarkey is a strategic communications lead in the Office of the Undersecretary of Defense for Acquisition and Sustainment.

The complete version of this article was originally published on the U.S. Department of Defense website, www.defense.gov.

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Approaching an era where automation and cognitive computing seamlessly connect to smart factories, supply chains are entering into a fourth industrial revolution known as Industry 4.0. This transformation, through advanced digital technologies across engineering and manufacturing, is set to bring the U.S. manufacturing ecosystem to the forefront of modernization—and with it, a demand for a sustained pipeline of talent and strong domestic manufacturing centers.

“America’s manufacturing ecosystem has been a vital engine of economic growth, innovation, and competitiveness for over 200 years—and has played a critical role in developing and driving the technologies that sustain our national security,” says Bill LaPlante, undersecretary of defense for acquisition and sustainment. “Today, the U.S. is in a technological and economic race to maintain its manufacturing edge, particularly as it concerns critical defense systems, such as satellites, advanced munitions and communications technologies.”

Advanced manufacturing is changing the nature of manufacturing—creating new, technically advanced and higher-paying positions.

Known manufacturing chokepoints across sectors—including skilled labor, machine tools, critical chemicals and a reliance on foreign resources—are impacting operational readiness.

The Defense Department is taking decisive action to combat these challenges to achieve two imperatives: to maintain capability and capacity to sustain legacy systems, and to expand and modernize manufacturing capabilities to build tomorrow’s defense systems. This effort requires significant investment in American workers and infrastructure, including \$372 million in the president’s fiscal 2023 budget to strengthen the nation’s supply chains through domestic manufacturing.



Department of Defense Office of Small Business programs director Farooq Mitha, right, visited the LIFT Manufacturing Innovation Institute in Detroit in March. *Credit: Devon Bistarkey*

The Industrial Base Analysis and Sustainment program within the Department’s Acquisition and Sustainment office is leading multiple projects designed to increase industrial manufacturing capability, supply chain capability and resiliency, and workforce development.

With 64 active and planned projects in key defense industrial base sectors, program efforts assemble a coalition of stakeholders and public-private partnerships designing, building, and producing critical technologies and chemicals to ensure warfighters maintain enduring advantages. Defense-critical sectors at the focus of these efforts include workforce, castings and forgings, microelectronics, batteries, kinetics, and critical chemicals.

Addressing the threat that an aging and shrinking manufacturing workforce poses to U.S. national security, IBAS invested approximately \$130 million across 16 unique workforce-related projects since the launch of its National Imperative for Industrial Skills initiative in 2020.

The model’s key principles emphasize identifying industry needs and driving collaboration with education, as well as looking at mutual reliance on like facilities, equipment, and processes driven by relevant industry needs. This approach focuses on developing a deeper and sustained collaboration among all levels of education (K–12, two-year post high school, and four-year post high school) and industry (small and medium manufacturers, large original equipment manufacturers), as well as nonprofit and governmental support activities.

One flagship IBAS effort working to address critical machine tool needs in support of defense manufacturing is America’s Cutting Edge program, which launched in March 2020. The effort combines the scientific expertise of the Department of Energy’s Oak Ridge National Laboratory; the research and teaching expertise of the University of Tennessee, Knoxville; and the workforce development leadership of the Institute for Advanced Composites Manufacturing Innovation to revitalize the U.S. machine tool sector through transformative thinking, technology, and training.

Through ACENet, an associated network of regional machine tool innovation and workforce development hubs in Florida, North Carolina, Tennessee, Texas, and West Virginia, the Defense Department is working to increase efficiency of existing machine tools while developing skills and training for next-generation machine tools for composites and metals. These initiatives include establishing efforts to rapidly train the next generation of machine tool designers and operators. ▀

For Stevanato Group, years of innovation have paid off

By David Holthaus

When the COVID-19 pandemic emerged, the race was on to not only develop a vaccine but to find ways to distribute it around the world. As drugmakers unexpectedly developed vaccines in a matter of months, the next critical step was to figure out how to contain, store, and safely ship massive quantities of the drugs so they could be administered at clinics, doctors' offices, hospitals, and drive-through sites everywhere.

For Italy-based Stevanato Group, a producer of pharmaceutical glass containers, it was an opportunity to respond to a global health crisis, expand its already growing business, and improve on an innovation the firm had developed a few years earlier that could accelerate the vaccine shipping and distribution network.

The company was one of the first to market a full range of ready-to-use glass vials for the pharmaceutical industry. Previously, drug manufacturers had to clean and sterilize glass vials before they could start filling the containers. It is an expensive and time-consuming process that demands resources that could be put to better use elsewhere in the pharmaceutical development process.

Stevanato's innovation, which it calls EZ-fill, provides drug makers with clean, sterilized glass containers that are ready to use and can be easily integrated into the drug manufacturer's processes.

"Everything that has to do with the cleaning and sterilization of the vials we do ourselves," says Riccardo Butta, president of Stevanato's Americas division. "What we ship to customers is ready to be filled."

"It was a major innovation for the market," he says. "It cuts down the cost of goods for our customers and makes life simpler for them."

The shipping process also avoids glass-to-glass contact, a critical factor in the transportation of vials, as it lowers the risk of scratches and other defects.

"We've increased the quality of the product we send to our customers," he says.

The availability of the ready-to-use innovation allowed Stevanato Group to quickly respond to the demands of vaccine makers during the pandemic and cut the time to market for their life-saving drugs.

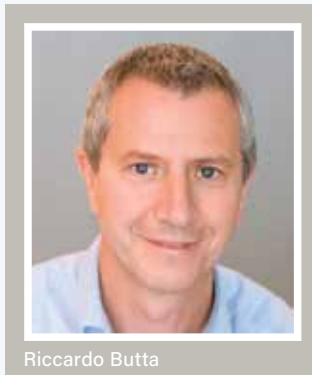
It also led to record sales, as the Group saw revenue grow 27.5% in 2021 to 843.9 million euro. Nearly 15% of the Group's overall revenue in 2021 came from its COVID-related business, it says.



At the Technology Excellence Center in Boston, Stevanato researchers test container performance and conduct chemical analysis. *Credit: Stevanato Group*

Stevanato Group is a rapidly expanding international company that sees innovation as a pillar of its growth strategy.

In late 2021, the company broke ground on the construction of a huge manufacturing facility, its first in the U.S., in Fishers, Ind., just north of Indianapolis. The \$145-million facility will support the expansion of its ready-to-use technology and put the company closer to its customers in North America.



Riccardo Butta

Central Indiana is developing a life sciences sector, building on the presence of healthcare companies there, such as Eli Lilly and Roche. The presence of Indiana University and Purdue University is also helpful to recruit engineering and scientific talent, Butta says. And it is closer to Stevanato's home base in Northern Italy than the West Coast.

"The time zone is important," Butta says. "Six hours to Italy is important, as opposed to nine or more from California."

The Indiana site is expected to begin operating in 2023. The plant will be a key piece of the Group's North America footprint, allowing it to serve its customers from the design and product development phase through manufacturing and commercialization.

One of those customers is the U.S. government. Earlier this year, the company announced a \$95-million agreement with the Department of Health and Human Services' Biomedical Advanced Research and Development Authority (BARDA) to expand capacity at the Indiana plant and provide priority access to BARDA vaccine and drug development partners.

The agreement “further confirms our strategic approach in the United States to invest and broaden our product offering,” says Franco Stevanato, the company’s executive chairman.

The manufacturing facility will work closely with researchers who do design and scientific analysis at Stevanato’s Technology Excellence Center in Boston, which it opened in 2020.

Located in the rapidly developing Seaport District of Boston, the R&D lab tests the impact of powerful drugs on glass containers. It also gathers data on the impact of the filling process on the formulations, and analyzes different types of container-closure systems, all of which are designed to help their pharmaceutical company customers minimize their time to market as they scale up and commercialize new drugs.

“The cost of these drugs is going up, so it becomes more critical for us to have the right quality,” Butta says. “Some drugs are very aggressive to the glass. We need to look for solutions for that so the container is not affected by the chemical properties of the drug.”

Boston was chosen as the site for the lab partly to overcome one of the chief obstacles to innovation—finding the right talent.

“There’s a lot of competition for talent,” Butta says. “Here there is the talent that we need.”

Greater Boston, including Cambridge, home of Harvard University, is a biotech hub, with companies such as Boston Scientific, Sanofi, Pfizer, and Novartis maintaining operations there.

“Many of our customers are here with their development centers,” Butta says. “It’s being embedded in the right ecosystem.”

Stevanato is innovating to increase the speed at which it can assemble and inspect its products.

“Speed gives you lower cost on everything,” Butta says.

The company is also employing artificial intelligence in the inspection process, allowing for its products to be more efficiently inspected for defects without human intervention.



Researchers at Stevanato’s Boston R&D center use high-resolution analysis to detect microscopic particles in glass. Credit: Stevanato Group

Founded in 1949, Stevanato Group accelerated its expansion in recent years. What began as a family-owned company, went public in 2021, raising \$672 million in its initial public offering on the New York Stock Exchange.

Earlier this year, it announced the acquisition of a facility in China, where it will employ 270 people to produce its EZ-fill syringes and vials and grow its presence in that market. And in May of this year, it announced the construction of another manufacturing facility in Italy that will employ 190 people when it begins operating in the second half of 2023.

The company is also innovating beyond its core product of pharmaceutical-grade glass vials. It is manufacturing an auto-injector that allows patients to administer their own drugs. It is also manufacturing a small, wearable, infusion device that can be programmed for a range of medications.

These innovations contributed to the company’s announcement that it is raising its revenue expectations for the full year 2022, even as revenue from its COVID-related business decreases as the global vaccine push tapers off.

A little more than year after going public, “We have met or exceeded our financial targets while advancing our long-term strategic goals,” Franco Stevanato says. ▀

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Eirich Machines Inc
Elan Technology
Elcon Precision LLC
Elkem Materials Inc
Endicott Clay Products Co
Equipceramic S.A.
Estee Lauder Companies
Exothermics, Inc
Ferro-Ceramic Grinding Inc
Fineway Ceramics
FIVEN AS
Fraunhofer Institute for Ceramic Technologies & Systems IKTS
Free Form Fibers
Fritsch Milling and Sizing, USA Inc
Fusion Ceramics Inc
Gasbarre Products (PTX Pentronix, Inc)
GE Global Research Center
GeoCorp, Inc
Gorka Cement Corporation
Greenlee Diamond Tool Company
Haiku Tech, Inc
Henry Brick
Hindalco Industries Limited
Hitachi High Technologies America, Inc
Höganäs Germany GmbH
HORIBA Scientific
INNEX INNOVATIVE INDUSTRIES
International Ceramic Engineering
Ivoclar Vivadent AG
J. C. Steele & Sons, Inc
JADCO Manufacturing, Inc
Japan Fine Ceramics Center
Jilin Changyu Advanced Materials Co, Ltd
Karlsruhe Institute of Technology (KIT)
Keith Company
Korea Institute of Industrial Technology
Kyanite Mining Corporation
KYOCERA Corporation
Laeis GmbH
Larkin Refractory Solutions
Lingl Installation & Service Co Inc
Lucideon
Magneco/Metrel, Inc
Materials Research Furnaces, LLC
Materion Ceramics
MINEREX

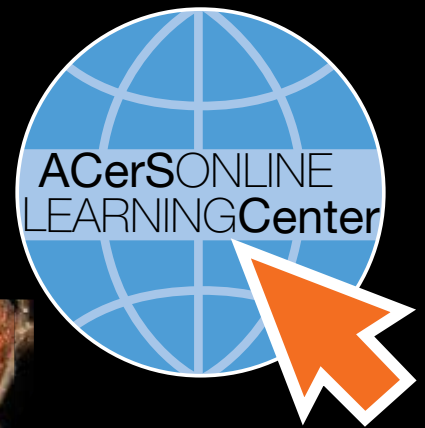
Mohr Corporation
MSE Supplies LLC
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NETZSCH Instruments North America, LLC
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Nexceris, LLC
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Owens-Illinois, Inc
Oxy-Gon Industries, Inc
Pacific Industrial Development Corp
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Plibrico Company LLC
Powder Processing & Technology, LLC
PRCO America Inc
PremaTech Advanced Ceramics
Rauschert Industries Inc
Refractory Minerals Company Inc
Refractron Technologies Corp
Refratechnik North America, Inc
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RHI US Ltd
Sandia National Laboratories
Sauereisen Inc
SELEE Corporation
Semiconductor Energy Laboratory Co, Ltd (SEL)
Shandong Shengquan New Materials Co, Ltd
SHOEI CHEMICAL INC
Showa Denko America, Inc
Sigma Advanced Materials
Silicon Carbide Products, Inc
SINTX Technologies
Special Shapes Refractory Company
SPT Roth Ltd
Sunrock Ceramics Company
Surmet Corporation
Swindell Dressler International Company
SynThera Biomedical Private Limited
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Thermcraft Inc
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