

ECO-FRIENDLY GLASS

# Product development has **BORMIOLI LUIGI** partnering with **PENN STATE**

## **C**OLLECTIVE INTELLIGENCE

LionGlass, a new family of glass engineered by researchers at Penn State, has secured its first corporate partner, a move toward bringing the eco-friendly alternative to standard soda lime silicate glass to market. Bormioli Luigi,

an Italian glassmaker that specializes in producing high-end packaging for fragrance, cosmetics and tableware, is the first company to enter an official partnership with Penn State to perform research and development with the goal of scaling up, manufacturing and ultimately commercializing LionGlass.

“This is an enormous opportunity to work with this material and create a more sustainable glass with far less carbon dioxide (CO2) emissions and energy consumption than standard glass,” said Elisa Biavardi, the chemical laboratory manager for Bormioli Luigi. “I see it also as



**BORMIOLI LUIGI has partnered with PENN STATE to develop LionGlass, an eco-friendly alternative to soda lime silicate glass. Reducing carbon emissions and energy use by half, this collaboration aims to scale up production. LionGlass offers improved durability – all with potential applications in luxury packaging while advancing sustainable glass manufacturing.**

an opportunity to learn from one another as we explore the possibilities for this major innovation in glassmaking.”

### **A WINNING ALTERNATIVE TO SODA LIME SILICATE GLASS**

As Biavardi explains, the partnership will focus on scaling up LionGlass to create bottles for luxury beauty products like cosmetics and perfume. By focusing on a smaller, high-end market, the company can fine tune the glass and determine the feasibility of scaling it up further for other uses. Here LionGlass is an entirely new type of glass that offers the first alternative to soda lime silicate glass, which has been used for thousands of years for everything from windows to bottles to microscope slides. Soda lime silicate glass is made by melting quartz sand with carbon-based ingredients -soda ash and limestone- at high melting temperatures of about 1,450 degrees Celsius (C). The high energy requirements for melting glass account for 70 to 80 percent of its carbon footprint. The

remaining 20 to 30 percent comes from decomposition of its carbonate batch materials, which release CO2 into the atmosphere.

### **CARBON FOOTPRINT REDUCTION**

Says John Mauro, the Dorothy Pate Enright Professor of Materials Science and Engineering at Penn State and co-inventor of LionGlass: “Worldwide, glass manufacturing produces over 86 million tons of carbon dioxide every year. LionGlass, which eliminates the use of carbonate batch materials and has a melting temperature roughly 400° C lower than other everyday glass products, has the potential to cut the carbon footprint of glass manufacturing in half.” Mauro adds that LionGlass also offers improved damage resistance compared to soda lime silicate glass. It’s roughly ten times more crack-resistant, which could enable lightweighting of glass products, further reducing the carbon footprint of glass production by lowering the carbon emissions used to transport the glass. He explains that last year,

Penn State filed a patent application for the composition of the first generation of LionGlass, which holds the potential to usher in a new era of sustainable glass manufacturing. The university recently filed a second provisional patent application for the next generation of LionGlass with further improved properties. Says Mauro: “We’re thrilled to have this close partnership with Bormioli to realize the full potential of LionGlass to reshape the industry. Indeed Bormioli is building upon a long history of innovation in glass manufacturing by moving towards methods that are more environmentally sustainable. We have very close alignment of our goals and look forward to partnering with them to bridge the gap towards commercialization.”

### **ADVANCING CUTTING-EDGE MOULDING TECHNIQUES**

Until now, LionGlass has been made in a lab setting using a crucible, a small, pot-shaped container used to melt glass at high furnace temperatures. To produce LionGlass at an industrial scale, it will need to be melted in large batches inside massive furnaces and formed using moulds, something that has not yet been tested with the new family of glass. The first year of the partnership will be dedicated in part to testing the feasibility of using the moulding technique with LionGlass in Bormioli’s existing manufacturing infrastructure. “This

## **ABOUT BORMIOLI LUIGI**

Bormioli Luigi is a specialized glass company based in Parma, Italy, with a world-class reputation of excellence in the manufacturing of high-quality perfume containers, spirit bottles, tableware and wine glasses.

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all started as just an idea in our lab, and now we're partnering with companies to bring it out into the world," said Nicholas Clark, a post-doctoral fellow at Penn State and one of the inventors of LionGlass. "We're translating what we're learning from the laboratory-scale, crucible melting that we're doing here at Penn State to a much larger scale of continuous glass production that's being done at Bormioli. It's exciting for our work to be this close to a major industrial innovation."

### PARTNERING FOR INNOVATION

Biavardi went on to describe Bormioli Luigi as a family-owned company based in Parma, Italy, since 1946. It is one of the world's leading glass manufacturers and a recognized pioneer in the use of electric furnaces. Indeed the Parma plant has been using electric furnaces since 1986, and today the Bormioli Luigi Group uses electricity for 65 percent of its production and is moving toward full green energy. This positioning illustrates a long-standing strategy of constant optimization. Said Andrew Read, senior vice president for research, Penn State: "This part-

nership is a testament to the ability of Penn State's research enterprise to address needs within the global marketplace. By marrying the creative spirit of discovery and innovation that Penn State is known for with the product development expertise of a highly respected cor-

porate partner, we can create a consumer product that is not only superior in durability but also lowers carbon emissions to help protect our planet from the effects of climate change. We are proud to partner with Bormioli and look forward to breaking new ground through this unique collaboration." ■

### BORMIOLI LUIGI

GLASSMAKER

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## ABOUT PENN STATE

Penn State is a multi-campus, land-grant, public research University that educates students from around the world, and supports individuals and communities through integrated programmes of teaching, research and service. Penn State is an R1 university, a classification given by the Carnegie Foundation for the Advancement of Higher Education to the very best research universities in America, reaching a record USD 1.239 billion in research expenditures during fiscal year 2022-23. The University's discovery-oriented, collaborative and interdisciplinary research and scholarship promote human and economic development, global understanding and advancement in professional practice through the expansion of knowledge and its applications in the natural and applied sciences, social and behavioural sciences, engineering, technology, arts and humanities, and myriad professions. The University's instructional mission includes undergraduate, graduate, professional, continuing and extension education - offered through both resident instruction and distance learning. Penn State's educational programmes are enriched by the talent, knowledge, diversity, creativity and teaching and research acumen of its faculty, students and staff. As Pennsylvania's sole land-grant university, Penn State provides unparalleled access to education and public service to support the citizens of the commonwealth and beyond. The University engages in collaborative activities with private sector, educational and governmental partners worldwide to generate, integrate, apply and disseminate knowledge that is valuable to society.