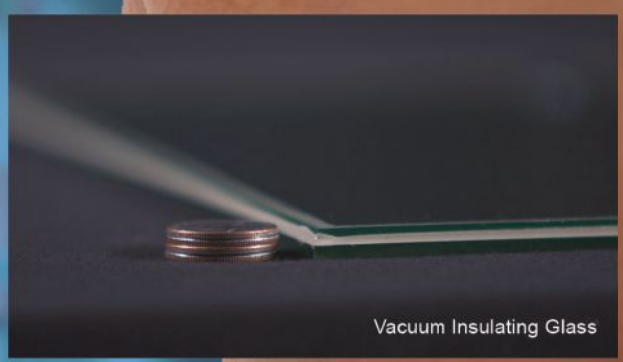
THE NEXT .30/.30

As COVID Bears Down on Manufacturing, Pressures Could Also Arise for More Efficient Glass

by Drew Vass

With a heavy focus on energy consumption among buildings, industry experts suggest that doors and windows could represent hot spots for improvements.



Photos: Pilkington

With more than half a century between the first (official) insulating glass units (IGUs) and today's double-pane IGUs with thermal spacers, multiple low-E coatings and krypton gas, one thing is clear: "The industry is a huge warship that turns slowly in the ocean," says Brad Boone, director of residential and specialty segment for Vitro.

"It's tortuously slow," adds **[DWM]** columnist Dave Cooper, a consultant for the insulating glass industry.

At the same time, "Once it starts and the momentum shifts in a certain direction, you're going to see it continue," Boone says.

It's all but inevitable that the industry will eventually follow through on more windows designed for triple-pane IGUs and advancements such as vacuum glazing and thin glass. A new administration in the White House has its sights set on energy usage among homes and buildings, so the journey toward better glass could end up looking more like a quick U-turn than a slow shift, some industry experts suggest—especially if tax credits are introduced.

"Today, even though we've improved windows so much and have all of these technologies we've added, the 15% of wall areas that windows represent in an average residence make up 50% of its heat loss," says Jim Larsen, director, technology marketing for Cardinal Glass Industries. For this reason, as materials and designs for such things as cavity insulation and exterior foam panels approach their limits, you can all but bet that federal initiatives will make their way to doors and windows, Larsen and others say. With the average high-performance, double-pane window stalled at around a 0.30 U-factor, "if you're going to take the next step on improving building performance, you're not going to put more insulation into ceilings," he says—not with so much room for improvement among windows.

Working Under Pressure

Exactly when a focus on more efficient homes will make its way to fenestration is debatable, but everyone agrees that if it happens any time soon, this could be a tough time to deliver. As COVID-19 bears down on the supply chain and operations, the demand for products has never been greater and manufacturers find it difficult to keep up.

"A year ago, we thought it was the end of the world," Larsen says. "Then April [2020] came and we said, 'Oh my, people are buying houses like crazy because of these ultra-low interest rates.'" It isn't often that the industry can describe the recent trajectory for demand as a "hockey stick," Boone says, "But right now we're living it."

With complaints echoing throughout the supply chain in 2020 and again early this year, "It reached a point where we were running 24 hours per day, seven days per week, and we were burning our employees out," says Larry Johnson, vice president of sales, North American Fenestration, for Quanex Building Products Corp. Quanex has since been able to dial back its shifts while keeping up, he says, "but you're also burning through raw materials."

If there is any blessing in the dilemmas facing most suppliers these days, it might be in the fact that they're industry wide, says Johnson Chen, general manager for Tempco Glass Fabrication. "I know that if I am having problems right now, that means that all the upstream suppliers are having issues and our clients are having the same," he says. "It's about us all working together to figure these things out. If there's one message I want to get across it's that we all need to stop blaming upstream or downstream providers. It's about how we work together amid this virus to get the job done."

A lack of labor, which is exacerbated amid COVID-19, remains a key issue. "Like everyone else, we are

Reality or Science Fiction?

Developers are working on a transparent form of aerogel to be used in place of gas.

From space shuttles to building materials, aerogels have long been considered one of the most advanced insulating materials on earth but considered commercially unviable for fenestration. In recent years, that's changed–with one company integrating the material into window frames. Now, developers are working to utilize the material in IGUs, in place of gas filling.

Dating back to the early 1930s, the synthetic material is made in many formats, but none clear enough to use in transparent glass. Meanwhile, Dave Cooper, a consultant for the insulating glass industry and president of Fenestration Consulting Services LLC, says that could change. Cooper is working with at least one group, he says, to develop a form of the material that's transparent.

"It's a very tricky formulation and application–to pour and fill the space between lites of glass with aerogel, but it's totally doable," he says. Similar to technologies like vacuum insulating glass, "To come up with a production line to make aerogel IG in any size or shape is going to be tough," he adds.

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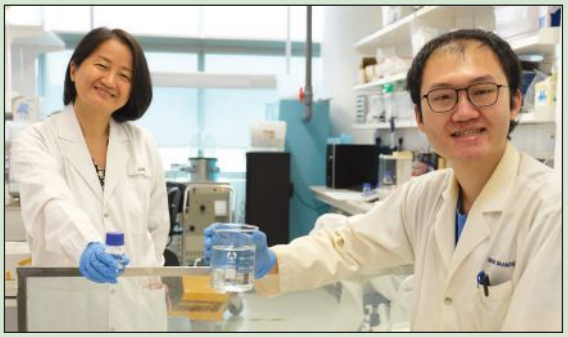
Liquid Filled Windows?



Dr. Long Yi (left), senior lecturer at the School of Materials Science and Engineering at NTU Singapore, and Ph.D. student Wang Shancheng (right)

Scientists at the Nanyang Technological University, Singapore, have developed a form of insulating glass that's liquid filled, to simultaneously block sunlight and regulate heat gain. The same technology, they say, also traps thermal energy that can be released to reduce energy consumption.

Researchers developed their liquid-filled "smart window" by using a hydrogel-based liquid developed from water. The liquid mixture turns opaque when exposed to heat, blocking sunlight. When cool, it returns to its original, transparent state.

When placed between glass lites, simulations show that the material can reduce heating and cooling costs by up to 45%, compared to standard IG. Researchers say it's also 30% more energy efficient than commercially available low-E glass, while being cheaper to make, they report.

The university's new window design is the first reported instance in a scientific journal of energy-saving windows using liquid.

getting absolutely killed with labor, whether it has to do with regional labor markets or unemployment causing people to stay home," Boone says.

Despite those challenges, most IG manufacturers say they're managing—partly by leaning on automation. But those that haven't already invested in equipment could be in for a rude awakening in 2021, as some machinery providers report that they're already sold out. In the meantime, manufacturers aim to eke out as much as possible from existing lines, while adding technologies in other areas.

"COVID-19, in many ways, brought us into the 21st century," Chen says. "We've realized how important it is for us to be more tech-oriented, in order to work remotely and to be quick and responsive—also to keep people from touching everything."

Eyeing the Shelves

When the pandemic hit, IG manufacturers had their sights set on new technologies capable of providing as much as R-10 performance, Cooper says. But many R&D departments are also slowed by labor issues. "Certainly, innovations have seen the same pressures that productivity has within our plants," Boone says. "For development, our technicians, and even the scientists to a certain point, have had slowdowns," including trouble reserving time on manufacturing lines for experimentation amid full-scale production.

Among the technologies that manufacturers eye for deployment is vacuum insulating glass (VIG), but the product currently is stalled by a lack of available sizes and a need for new designs that allow VIG's uninsulated edges to slot deeper into window frames for thermal protection.

Developers are also faced with the need for faster and more affordable methods for VIG production. Currently, lines cost around ten times as much to deploy as standard IG equipment, Cooper says, and production is unable to match the output necessary to keep up with the window industry, Boone adds. "Can we make 50 VIG units per day? Yeah, that can be done," Boone says. "Are you going to be able to do that on a high-speed manufacturing line, where guys need to produce 800 to 1,500 units per day for downstream demands? We don't see that happening as of yet." For this reason, he says that Vitro is still "years away" from what he describes as true manufacturing capabilities.

Accelerating the Turn

Some window manufacturers are eying and working toward other possibilities concurrently. Sierra Pacific Windows, for instance, is weighing the use of thin triples—a form of triple pane IG that utilizes thin glass as an inner lite to (among other things) cut down on weight and thickness compared to standard triple-pane.

"Thinner triples that are coming to the market hold much promise and continue to be on our watch list," says Rick Audsley, director of engineering for Sierra Pacific Windows. At the same time, "Hurdles of these product developments have been availability and handling of the thin panes," he adds.

Johnson says the dilemma for handling thin glass is one that manufacturers have grappled with for years. After spotting the material at a trade show in China, "I was lucky enough to grab one and bring it back in my duffle bag," he says. "I packed everything around it and it made it all the way back to Ohio—intact. I walked into George Wilson's office, who was

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