Disruptive

Increasingly Complex Architectural Glass Means Re-Thinking Quality Assurance

by Ellen Rogers

The increasing complexities of architectural glass, including larger sizes, have brought awareness of and a need for anisotropy inspection equipment.

In less than a decade, “anisotropy” has gone from being a tough-to-pronounce, nebulous term, to one everyone’s talking about. Some people still have trouble pronouncing it and many don’t know what it is, but no one wants it in their glass.

Anisotropy isn’t new. It’s iridescence—the colorful patterns in heat-treated glass that are visible under certain light and viewing conditions—and it’s been around as long as heat-treated glass itself. Why the focus now? Why is there so much discussion about figuring out ways to measure and minimize its occurrence and appearance? That push aligns with another mega trend: bigger, thicker glass. As glass sizes increase, so, too, does the possibility of visual distortion. A decade ago, before everyone was looking for jumbo spans of glass, iridescence was a minor concern, because it wasn’t as visible. As sizes have increased, so has that level of visual distortion. And that’s something architects don’t want to see. As a result, inspection equipment companies are developing tools that can help fabricators measure and control their processes to avoid or minimize these anisotropic conditions. The technology is available, but it’s in its infancy, and can be expensive. As the demand for increasingly complex, bigger glass continues, fabricators will have to decide whether the equipment investment is necessary for their operations and ask themselves: is this the market for me?

Why the Need

Louis Moreau, head of technology and innovation with AGNORA in Collingwood, Ontario, Canada, has spoken at a number of architectural glass events on topics related to anisotropy. He is also leading the efforts to develop an ASTM standard test method for anisotropy measurement on glass. In 2016, Moreau and the AGNORA team partnered with McMaster University to study four optical phenomena: haze, anisotropy, clarity and interference fringes. The results of the study were presented at the 2017 Glass Performance Days conference in Tampere, Finland, sparking dialog with several key stakeholders to start addressing anisotropy measurement. *(See box on page 78 for more on this.)*

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Innovation

Photo: AGNORA

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"Bigger, thicker glass is more likely to mean anisotropy because there's more heat treatment involved and more stresses in the glass," he says, adding that anisotropy isn't just an issue with the glass, but also with viewing conditions.

"The architectural world has become aware that it's not just the glass, but where it's installed ... looking at the glass from a certain position it can change the view of the building. If you look at interior glass you will never see it because there's no polarized light," he says.

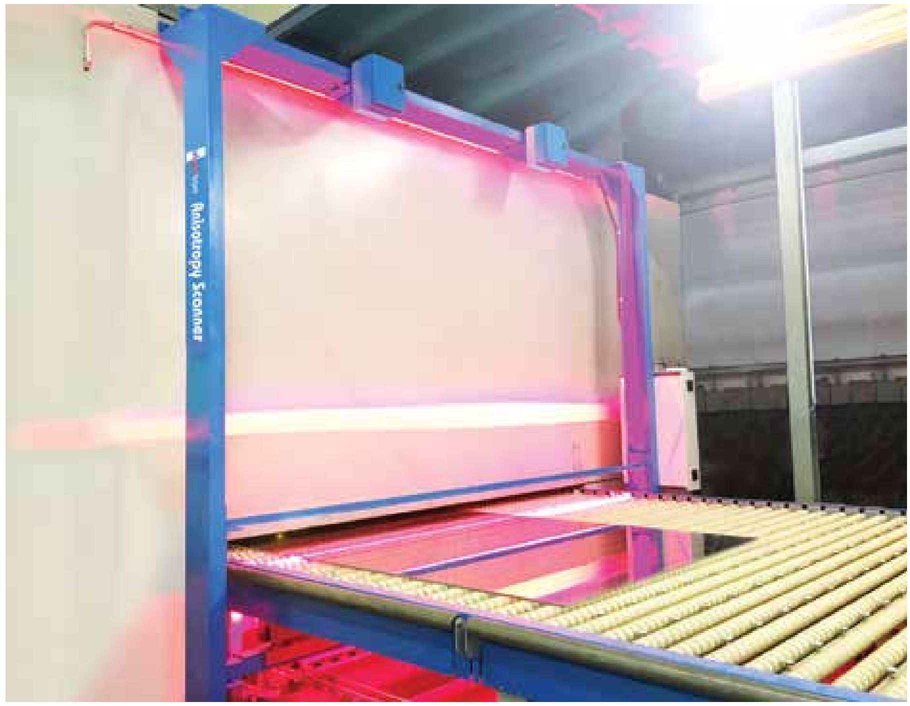
Jakub Kowalczyk, sales manager with LiteSentry in Northfield, Minn., agrees that market conditions have been the primary driver.

"Architects, customers, developers and consumers are becoming savvier and are requiring higher quality glass that doesn't have iridescence," says Kowalczyk. "As the top 10 to 20 percent of the market began producing higher quality glass, the end-users began to see a higher quality alternative."

Historical Perspective

Before anisotropy was the buzzword, roller-wave distortion was the hot topic. While both are optical distortion conditions, the issues surrounding each are different. Kowalczyk sees them as being mutually independent. "Any correlation we've seen would be coincidental. We've seen glass exquisitely flat, but with horrible iridescence. We've seen optically distorted glass with zero iridescence," he says. "Twenty years ago roller wave distortion was considered inherent in the tempering process, but once you were able to measure it, we could develop the tools and processes [to control] it," says Kowalczyk. "These aren't luxury tools anymore. Architects and the early adopters of these technologies are starting to demand it and others will follow. They don't want iridescence in the glass and they won't accept that 'it's inherent in the process.' They want it fixed."

Michael Schmidt, North American representative for the German company Viprotron, agrees the industry is starting to repeat with anisotropy what it did two decades ago with roller wave distortion.



Viprotron is one of several companies that has developed anisotropy inspection equipment that can be installed on tempering lines.

"There was a lot of difficulty and resistance to developing a roller wave standard of measurement and now it's understood ... We're now seeing that in the need to identify the next level with anisotropy. How do we start to identify that and correct for it in the production process? I think we're at the recognition level and people are starting to understand the definition and description of it."

Schmidt adds that the demand and interest in measuring and controlling anisotropy began with the contract glaziers who heard about it from builders and architects, as well as the "confident fabricators who began looking at ways to start to control and measure it. Now we're getting to a point where companies are producing equipment with different levels of measurement/criteria to meet [those needs]."

Moreau says that questioning the need for anisotropy equipment is a lot like what the industry saw with heat-soak testing several decades ago.

"No one had a testing device for it and people thought it was just an inherent part of the process. Then some progressive people said, 'no, it's a nickel sulfide inclusion,' and a test was developed and now it's mainstream.

"It's the same with anisotropy. Everyone said 'it's inherent and you can't do anything about it.' But you can. It will vary based on furnace design ... [and other] factors that influence anisotropy. If your oven is not good, the only way to get rid of anisotropy is to get a better furnace."

Why Inspect?

For companies pondering whether inspection equipment is necessary, experts are quick to point out there are many benefits to making the investment.

"The first is that what gets measured gets done," says Kowalczyk. "We can give customers live data that allows us to show what the glass will look like in the field along with other process control information. Then they can instantly make decisions on how to adjust the furnace, process, etc. If you don't measure the key components and benchmarks you're going to have a piece of glass that looks like a funhouse mirror, and ultimately you're going to see these issues in a high-profile buildings, and that's going to be a failure and it's going to be expensive to fix."

Another benefit of automated inspection is the increased level of accuracy in finding errors. As Schmidt explains it, human-eye-based inspection capabilities are dramatically reduced after a short period of time. After looking at

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Equipment Innovation

Today's architects are calling for increasingly complex, high-quality glass. Those demands have also brought a need for greater inspection tools and equipment.

Louis Moreau, AGNORA's head of technology and innovation, points out that inspection scanners have been in float plants for approximately 30 years.

"The laser-based scanners used on float lines analyze the ribbon, but only for bubbles and stones. They can detect defects and now all float plants have these," says Moreau, adding that the scanners to look at optical distortion were originally developed for the automotive industry, and were super sophisticated machines using lasers.

"There's always a desire to quantify the optical quality of glass," he says. "This is localized when you have a scanner, because you have a whole picture of the sheet glass. Having the availability of technology has also brought that awareness to the market."

Jakub Kowalczyk, sales manager with LiteSentry, says these developments provide both quality control, as well as process control.

"You can produce higher quality yields so, that helps improve cost and increases profits," he says.

Kowalczyk says his company has gotten a lot of feedback on the anisotropy measurement system it introduced two years ago with Stress Photonics.

"The changes we've seen have been in how we can interpret the data to show what the glass will look like in the field and we work with customers on how best to produce iridescence free glass," he says.

Michael Schmidt, the North American representative for Viprotron, says he's seen the need directly from fabricators for a consistent, objective method for inspecting and/or analyzing glass, regardless of the process—laminating, insulating, tempering, etc.

"There are two drivers: one from an operator standpoint and one from a final product perspective," he says, explaining that while more than 90 percent of the insulating glass fabricators in Europe have some type of automated inspection already in place, it's still developing in the U.S.

"[Production lines] require an objective method that can be done regardless of what the end use of the product is," he says. "That's what quality inspection enables you to do."

Schmidt adds that fabricators are showing interest in this environment today, because advances in inspection equipment and technology allow them to be able to do more with less. So while less of an operator's time will be needed, he's quick to point out that an operator is always involved.

"The decisions still have to be made, there still has to be interaction, but it's reduced greatly from someone looking over everything about the glass to someone looking at an output screen that shows what was rejected and why, and recognizing that it can either be remedied or has to be removed from the production process."

Moreau says his company currently has three different types of scanners. This type of equipment, though, is still in its infancy, and Moreau is heading efforts to develop an ASTM standard to address these measures.

"[This standard] will only be on how to measure anisotropy and to make sure we all have the same numbers; so everyone in the world has the same unit of measurement and a calibrated way to look at the machine," he says. "We want to provide a reliable number, not evaluate is what good/not good."

Moreau expects the standard to go to ballot later this year.

glass continuously for eight hours there is fallout in the human's capability to define defects. As a result, operators can be faced with both eye and mental fatigue, and that's why automated inspection tools can be so helpful.

It's Not for Everyone

Regardless of the benefits, this type of investment may not be one every fabricator can make.

"Fabricators need to look at their target market and what they want to be as an organization; what is their main driving factor?" questions Kowalczyk. "It could be internal, in that they're not producing enough yield. If the operators aren't the best or aren't trained properly they won't get what they're supposed to from the equipment. Look at your market, customers and what you need to be able to produce."

Schmidt points out, though, that tools and equipment for measuring anisotropy won't be necessary for every company.

"There will be room in the industry for different levels of capabilities and production. It was the same with roller wave and the different types of furnaces. So, even the big fabricators with multiple sites, it's unlikely they will outfit all of their facilities—and many may have multiple furnaces," he says. "They can't add this equipment to all sites right away, so you diversify the type of projects you're capable of doing. There will always be room for different types of production quality and requirements and it depends on the application. It doesn't affect shower doors, for example."

Complex or jumbo glass fabrication isn't for everyone, but neither is a simple storefront. Every company, regardless of size, is unique and each is driven by different priorities. ■

the author

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