Bending razor-thin glass to tech's future needs

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"We don't make that kind of glass," said Waguih Ishak, director of Corning Inc.'s West Coast Research Center, pointing to the windows lining his office and, beyond that, to the windshields of the cars parked outside.

"That is very thick glass, where impurities and small defects don't really matter. At Corning, we make electronic-grade glass."

Ishak knows that to the layman, this doesn't mean much.

Glass is glass. You can see through it, it keeps things out, and it breaks.

What more could Corning's lab in Palo Alto do besides make it a little thinner, a little smoother and a little clearer?

Ishak smiled. His face was friendly, but the knowing look in his eyes was clear: You have no idea.

He played with a plastic-like sheet between his hands, bending it back and forth.

"This is Willow Glass," he said, forming a bell curve with the sheet. "It's 0.1-millimeter-thin glass."

Corning can now mass-produce Willow Glass and ship it around the world in large rolls.

"And this," he said, tapping on some smaller pieces of glass on the table, "is Gorilla Glass."

Gorilla Glass is the glass in iPhones. Thanks to Corning's chemical formulas, it's the reason phones are now more scratch- and shock-resistant than earlier models.

Now picture this, Ishak said: razor-thin glass with the flexibility of plastic and the durability of steel.

Think what it would mean for mobile devices.

Heck, think what it could mean for any electronic device with a screen.

This isn't a pipe dream, he said. Scientists at Corning - a company that creates the recipes and processes to manufacture glass used in smartphones, televisions and even space shuttles - are finally having technological breakthroughs that could make glass, an often overlooked component of electronic devices, sexy.

Or, in Ishak's eyes, sexier than it already is.

"Plastic ages," he said. "After a few years it becomes yellow and deteriorates. Glass doesn't."

He continued: "If you have a 1-millimeter sheet of plastic, it will take an oxygen ion (that is, moisture) a few hours to get through it. Moisture is terrible for electronics. If you have a 1-millimeter piece of glass, it will take 30 billion years."

"So!" Ishak said, raising both eyebrows, satisfied he'd made his point. "Hmm!"

Beyond the inherent properties of glass, though, Ishak has reason to believe in the material. Willow and Gorilla Glass aside, he's leading a team of scientists and engineers at Corning to make glass do things most people thought were impossible. Thinner, stronger, flexible, anti-glare, anti-bacterial - and that's just the start of it.

In Corning's factories, high-quality raw material comprising sand and other material is melted and poured down the exterior of a structure that resembles a trough. The molten glass flows down each side of the trough, meeting at a point at the bottom. Here, the substance fuses together (thus the name fusion glass manufacturing) and gravity continues to pull it down. As gravity pulls it, the substance begins to cool into sheets of glass.

This is a process that Corning has used for the last few decades to make glass.

More recently, though, Corning has added a step to the process. As the substance cools, Corning attaches it to a roll, which pulls the sheet even further, making it thinner. The result? Glass that gets as thin as 0.05 millimeter.

It's not as simple as stretching the glass out like pizza dough, though. Corning scientists have spent years tweaking the chemical composition, time, pressure and temperature to make it work. Willow Glass was made possible only a year or so ago.

Thinner glass can obviously mean thinner devices, but these new processes are producing glass so pristine that Ishak predicts they'll soon be able to support 4K or higher resolution video on mobile phones.

Another thing: "Every time I shave 0.1 millimeter, it allows for a bigger battery," Ishak said. "Bigger battery means more time between charges."

The company is also making strides with stronger, steel-like glass.

On Ishak's table, where small squares of Gorilla Glass sat, he tapped on a square of non-Gorilla Glass.

"This one is ordinary soda lime," Ishak said.

Soda lime is the kind of glass used for drink bottles and windows.

Using a tool that resembled a metal crochet needle, he pressed one end against the glass. With little effort, it cracked.

"This one is soda lime that we've treated with some chemicals," he said, tapping at the next piece of glass.

This time, Ishak had to apply a bit more pressure, but again, the glass cracked.

"And this third one is Gorilla Glass, which we made, and plunged in a special chemical bath. The recipe is our intellectual property."

Ishak threw his weight behind the metal needle, pushing it into the third piece of glass. It stayed put.

"And this last one is the next iteration of that."

This time using both hands, he pushed the needle into the millimeter-thin square. The glass didn't budge. It didn't even scratch.

These developments are a big deal, according to industry experts who believe advancements in glass alone could change the way we make and use mobile devices.

"I see the immediate use of this ultra-thin glass will be improving the durability of phones," said Andrew Hsu, head of the concept prototyping team at Synaptics, a firm that develops touch screens and displays. "It's amazing to think everyone has a $600-to-$800 device that's incredibly complicated, and people use and abuse them and throw them around."

More durable phones could also mean the end of phone cases, which, according to Daniel Hays, a principal partner at PwC, could "improve the viability of having dual-screen phones where the back of the phone serves a different purpose," he said. A second screen, perhaps? Maybe a touchpad?

Or, according to Hsu, if glass can get so thin that it's bendable while retaining its strength, think of the different forms devices could take.

"In the early days of phones, there was a diverse ecosystem of handsets that took many different forms and shapes," he said. "Then, after 2009, every one had a rectangular slab."

Tougher devices, more powerful and longer-lasting devices, and more diverse devices are all inching closer to reality all thanks to, yes, glass.

And with glass becoming so thin and flexible, researchers around the world are even exploring flexible electronics: phones that can be folded in half, tablets that can be rolled up like a fruit roll.

According to Ishak, glass is ready for fruit roll technology. Willow Glass already comes on a roll. The rest of the electronics industry just isn't quite ready to get that sexy.

But when it is, Ishak said, Corning will be ready.

And when the roll-up phones are finally made?

"I'll be the first to buy it!"