AS THE WORLD HEADS INTO ITS SECOND YEAR OF FIGHTING the novel coronavirus, surface coating specialist NBD Nanotechnologies is bringing a new weapon into battle in the form of an antimicrobial and antiviral coating that can be applied to glass smartphone displays.

The Lexington, Massachusetts-based company already has a significant footprint in the smartphone and tablet market with its InvisiPrint anti-fingerprint technology. InvisiPrint is spray coating applied to glass displays that diffuses the oils left behind when a finger touches a screen, so that light easily can pass through, leaving the fingerprint undetectable. NBD also makes a family of coatings used in many protective smartphone cases called RepelFlex, which offers antimicrobial properties as well as dirt and stain protection.

Its newest product, InvisiPrint MBED, adds antimicrobial properties to the InvisiPrint product, with an EPA-approved active ingredient that reduces 99.999 percent of odor- or stain-causing bacteria while also continuing to hide fingerprint smudges. NBD began working on the new coating back in 2019, well before COVID-19 hit, and plans to launch it in early 2021.

“We started to see a trend of people going toward antimicrobial even before COVID-19—a year before COVID-19, that trend was starting,” says NBD Nanotechnologies president and co-founder Miguel Galvez. “And then as a result of COVID-19, it became almost a requirement.”

Before InvisiPrint MBED, there were two main ways to combat microbes on a glass display, says Galvez. One approach, used by Corning, is to etch silver ions directly into the glass. Another technique, employed by Irish firm Kastus Technologies, is to spray a titanium solution onto the glass and then heat it in a process called sintering.

While both techniques are effective in combating pathogens, Galvez says, they are expensive. And they also don’t do anything to combat fingerprints. Adding anti-fingerprint protection to the display would still require spraying on another coating, a second step that also hinders the performance of the initial antimicrobial treatment.

“We came along and said what if there was a way to blend antimicrobial into our anti-fingerprint coating, we could cut a lot of cost out of the system,” Galvez says.

NBD solved the problem by developing its own silane-based antimicrobial technology that can be blended with the silane-based InvisiPrint. The company says the new antimicrobial treatment will reduce more than 99.999% of stain-causing bacteria within 24 hours when tested against JIS or ISO standards, with a durability of several years. It is currently pitching InvisiPrint MBED to OEMs, and recently formed a partnership with screen protector manufacturer BodyGuardz to use the technology.

NBD also is looking to market the Invisiprint MBED technology beyond smartphones, tablet, and laptops by targeting business-to-business applications such as point-of-sale systems and other high-touch screens such as bank ATM displays. It probably would do so with a partner in a new business model.

Before COVID-19 hit, many chemical analysts viewed antimicrobial coatings as a niche product without mainstream appeal, Galvez says. But COVID-19 “changed the game on that.” Now, even if a vaccine is successful and the pandemic is over by mid-2021, Galvez expects a long-term tailwind for antimicrobial technologies as consumers grow tired of constantly disinfecting their devices and instead seek durable protection. As Galvez says, “People are going to want surfaces that stay clean.”

—Glen Dickson
RESEARCHERS FROM THE SAMSUNG ADVANCED Institute of Technology (SAIT), Samsung Group’s R&D center in Suwon, South Korea, and Stanford University in the US have collaborated to develop a new OLED display technology that they say can achieve resolutions of up to 10,000 pixels per inch (ppi). That is far more than the 100 to 200 ppi resolution of white OLED TV displays and the 400 to 500 ppi of red, green, and blue (RGB) OLED smartphone displays.

The new OLED architecture, produced in lab tests and described in a Science paper co-authored by SAIT scientist Won-Jae Joo and Stanford professor Mark Brongersma, repurposes work in nanoscale photonics that Brongersma originally did for creating ultra-thin solar panels. It uses an optical metasurface and a base layer of reflective metal with nanoscale (smaller than microscopic) pillars, in combination with another reflective silver film.

The nanopillars, which measure 80 nanometers (nm) high and 100 nm wide, are arranged in square clusters to serve as pixels that measure roughly 2.4 microns wide (less than 1/10,000 of an inch). When white light is emitted between the two layers, individual nanopillars within these clusters reflect red, green, or blue light, depending on the spacing between them. This colored light then reflects back and forth between the reflective layers before eventually escaping through the silver film onto the display surface. The way the light builds up between the two layers creates twice the luminescence efficiency compared to the traditional white OLED display technology used in TVs as well as higher-color purity, the researchers say.

Virtual reality (VR) displays were identified as a potential application for the new OLED architecture. That’s because the display inside VR goggles needs to have extremely high resolution to overcome what is known as the “screen door effect,” where the VR experience is compromised because the viewer sees the space between the pixels when looking at a screen only a few inches from their eyes. To create a truly immersive VR experience, a display needs to approach the resolution of human 20/20 vision, which is 60 pixels per degree of vision or just over 10,000 pixels of resolution per eye, says Zine Bouhamri, a technology and market analyst for Yole Développement.

While the new OLED architecture developed by Samsung and Stanford would seem to present a solution, Bouhamri is skeptical. He notes that there would be significant manufacturing challenges to create such displays at volume. And even if they created a full OLED display with more than 10,000 ppi resolution, the computational power to deliver that resolution across the entire display would be hard to support in a wearable headset running on batteries.

Bouhamri thinks a more viable approach for realistic VR is the one being taken by Finnish firm Varjo, which combines an ultra-high-resolution OLED microdisplay with a conventional OLED display in its VR goggles. The image from the microdisplay is reflected by a mirror onto the conventional OLED to give a highly defined subscreen in the middle of the regular screen. Eye-tracking technology then is used to keep the microdisplay’s reflected image centered in front of the retina, where human vision is at its most accurate, as the viewer shifts their gaze back and forth inside the goggle.

“That saves a lot on the computational power that’s required,” Bouhamri says.

Sony is a leader in such OLED microdisplays. Other companies are developing microLED microdisplays for VR including Jade Bird Display in China and VueReal in Canada.

—Glen Dickson

Developers say the new OLED display technology can achieve resolutions of up to 10,000 pixels per inch.
LG DISPLAY IS ON THE UPSWING

SOUTH KOREAN DISPLAY GIANT LG DISPLAY (LGD) POSTED STRONG financial results for the third quarter (Q3) of 2020, riding increased OLED production capabilities and a turnaround in LCD panel prices to turn a profit after seven straight losing quarters.

LGD posted an operating profit of US$147.2 million compared to an operating loss of US$464.1 million in Q2 2020. LGD's revenues for the quarter were $6.05 billion, a 27 percent increase from the previous quarter and 16 percent jump from Q3 2019. Net income for Q3 2020 was $9.87 million, compared with a net loss of $452.4 million in Q2 and a net loss of $396.7 million in Q3 2019.

The company says the strong results were driven by a rise in IT panel shipments, an uptick in mobile displays supplied to key customers, strong TV sales, and the ramp-up of production at its new OLED fabrication plant in Guangzhou, China.

LGD emphasized the growth in the IT display sector, which is somewhat attributable to increased home schooling and remote work during the COVID-19 pandemic, and progress in its OLED business on its earnings call. But probably the biggest reason for the company's change in fortunes was the dramatic increase in LCD panel prices during 2020 after hitting an all-time low just prior, says Eric Virey, senior analyst at Yole Développement.

"Frankly, for me the main driver for their good financials this year is that LCD prices have been going up a lot," Virey says.

In November 2019, commodity 32-inch LCD panels were selling for $30, Virey says, while now the price has doubled and they are $60 per panel. And prices for 55-inch LCD panels for TVs are up some 65 percent over the same period, rising from $100 in November 2019 to around $167.

Virey notes that LGD initially planned to shut down manufacturing of LCD panels for TVs in South Korea in light of the competitive pressures brought by Chinese fabrication plants, but has now put those plans on hold. Like its rival Samsung, LGD had already shifted some of its LCD capacity toward making higher-margin IT displays such as desktop monitors and laptop displays heading into 2020. That business received a boost from the COVID-19 pandemic in Q2, and Virey now sees strong demand for IT displays holding through early 2021.

LGD says IT panels comprised 43 percent of its revenues for Q3 2020, with TV panels accounting for 28 percent and panels for smartphones and other devices representing 29 percent.

LGD's OLED TV panel business has gotten a capacity boost since its new fabrication plant in Guangzhou came fully online in July, allowing it to now make 48-inch OLED panels. But Virey notes that LGD actually has lowered its projected total shipments for OLED TV panels for the year, from an initial 4 to 5 million to 4.2 to 4.5 million. The company does project total OLED shipments of 7 to 8 million units next year as it ramps up production in Guangzhou.

"The challenge they have now is by officially starting the fabrication plant in July, it means they've started to depreciate it, so it's starting to show in the financials," Virey says. "So, they have to very quickly try to fill up the fabrication plant and operate at a high utilization rate."

The growth story in LGD's mobile OLED panel business is stronger, as the company has recently won more business from Apple at the expense of Samsung. Virey estimates that LGD shipped around 5 million OLED smartphone panels to Apple last year, compared to about 50 million for Samsung. This year he expects LGD will ship about 20 million panels to Apple compared to 80 million for Samsung, thereby quadrupling its volume while gaining market share.

"They've been going after Samsung for a long time without much success until recently," Virey says. "This year they're finally starting to score big with Apple."

In other LGD news, the company has rolled its transparent OLED display technology across two major subway systems in China. The 55-inch displays with touchscreen capability have been installed on Line 6 in Beijing and Line 10 in Shenzhen, where they are being used to show real-time information about subway schedules, routes, and status as well as news and weather reports. LGD says it hopes to bring them to other subway lines in China in the future.

While Samsung first showed transparent OLED displays at the 2012 Consumer Electronics Show (CES), LGD's subway installation in China is by far the biggest deployment of the technology to date, Virey says. He says he doesn't see transparent OLED taking off as a mainstream product, but thinks it may find favor for some high-end retail or public display applications. At the very least, the subway application is a nice showcase for the technology.

"It's a nice little niche for LG that's probably very profitable, but that's not what's going to drive their business in the future," he says. —Glen Dickson