New type of semiconductor could change face of consumer electronics

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Materials first developed at Oregon State University more than a decade ago with an eye toward making "transparent" transistors may be about to shake up the field of consumer electronics – and the first uses are not even based on the transparent capability of the materials.

Transparent transistors were invented by OSU researchers in 2002. In continued work and in collaboration with private industry, certain transparent transistor materials – amorphous oxide semiconductors – are now gaining some of their first commercial applications. Licensing of the compounds is under way to a range of companies.

One of the first and most important of the semiconductors is based on the compound indium gallium zinc oxide, or IGZO. It's now being used to produce flat-panel displays for computer monitors with extraordinary resolution and clarity, and in ultrathin HDTVs. IGZO will also soon find its way into tablets and cell phone displays.

But that may be just the beginning, experts say.

"Amorphous oxide semiconductors appear well-positioned to significantly impact a $100 billion industry," said John Wager, holder of the Michael and Judith Gaulke Chair in the OSU School of Electrical Engineering and Computer Science.

"Because of their increased electron mobility, compounds like IGZO can provide brighter displays with higher resolution," Wager said.

Transistors made using IGZO consume much less standby power - cell phones might be created that only need charging once or twice a week instead of once a day.

The primary competition for amorphous oxide semiconductors is low-temperature polysilicon, Wager said. But this technology is more complex and expensive.

"Amorphous oxide semiconductors benefit from the fact that they can be implemented by retrofitting an existing fabrication facility," Wager said. "This would save billions of dollars, rather than having to build a new plant, as required for low-temperature polysilicon.

"Amorphous oxide semiconductor implementation appears on the verge of exploding," he said. "If the current trend continues, in the next five years most people will likely own some device with these materials in them. This is a breathtaking pace."

The commercialization of amorphous oxide semiconductors also bodes well for the future of transparent electronics.

Conceptually, electronics could be incorporated into any glass surface. A bathroom mirror could display your schedule for that day in an updatable and interactive way. A window could function as a computer display in conjunction with touchscreen control. Driving directions could appear on the windshield of your automobile. Or you could replace your drapes with a bedroom window that would automatically or manually darken to block out light.

Provided by Oregon State University

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