Transparent Semiconductors May Be Future of Flat Panel Display Industry

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Some types of “amorphous oxide” transparent semiconductors originally developed in the College of Engineering at Oregon State University may form the basis for the next generation of flat panel displays, providing better performance at a lower cost.

Liquid crystal displays – ubiquitous in everything from televisions to personal computers and cell phones – are already a $100 billion global industry, and researchers say the new materials may be the next step in the industry’s evolution.

A new project was just initiated to further study these materials, understand their physical characteristics and speed commercialization.

These developments are another outgrowth in the field of transparent electronics that OSU scientists have pioneered in recent years. The university will participate in further studies on them as part of a collaborative research effort which was just announced with Applied Materials, Inc., and will be supported by the U.S. Display Consortium, a public/private partnership in this area.

“The flat panel display industry has grown about 25-30 percent a year for the past decade,” said John Wager, a professor of electrical engineering at OSU. “But the existing technology may not be adequate for what we want to do with some of the newer products in the next generation. Some very major companies have said that amorphous oxide semiconductors are probably the technology of the future.”

Two compounds of particular interest, Wager said, are an indium-gallium-zinc oxide semiconductor developed in Japan, and a zinc-tin oxide semiconductor developed at OSU, which in conjunction with HP holds numerous patents in this field. Both should be environmentally benign and perform well, but the OSU semiconductor can be made from inexpensive, common materials – a key commercial advantage.

During the coming year, OSU researchers will work with scientists from Applied's Display Business Group-AKT. The metal oxide films under development should have higher electron mobility, the potential to reduce costs through lower temperature processing, and good function for flexible displays or organic light emitting devices, researchers say.

"This technological approach of using amorphous oxide semiconductors rather than conventional amorphous silicon should result in improved transistor stability," Wager said. "Continued advances in their performance, low cost and ease of manufacture should all be important to the growth of this industry."

The new materials being studied are an outgrowth of OSU's creation in 2003 of the world's first transparent transistor, a see-through electronics component that researchers at the time said should open the door to many new products. The first compound was made of zinc oxide – a common compound most people might recognize as an ointment often used to prevent sunburn – and other compounds have evolved from continued research.

Last month, another use of transparent electronics was also announced in solar energy systems. The university is collaborating with HP and Xtreme Energetics., Inc., of Livermore, Calif., to create solar energy devices that developers say will be four times more cost-efficient than any existing technologies.

Further industrial development, employment and new consumer products are all possible as the era of transparent electronics evolves, OSU researchers say.

OSU scientists also just published the first-ever book in this field, titled "Transparent Electronics," through Springer Science and Business Media.

Source: OSU