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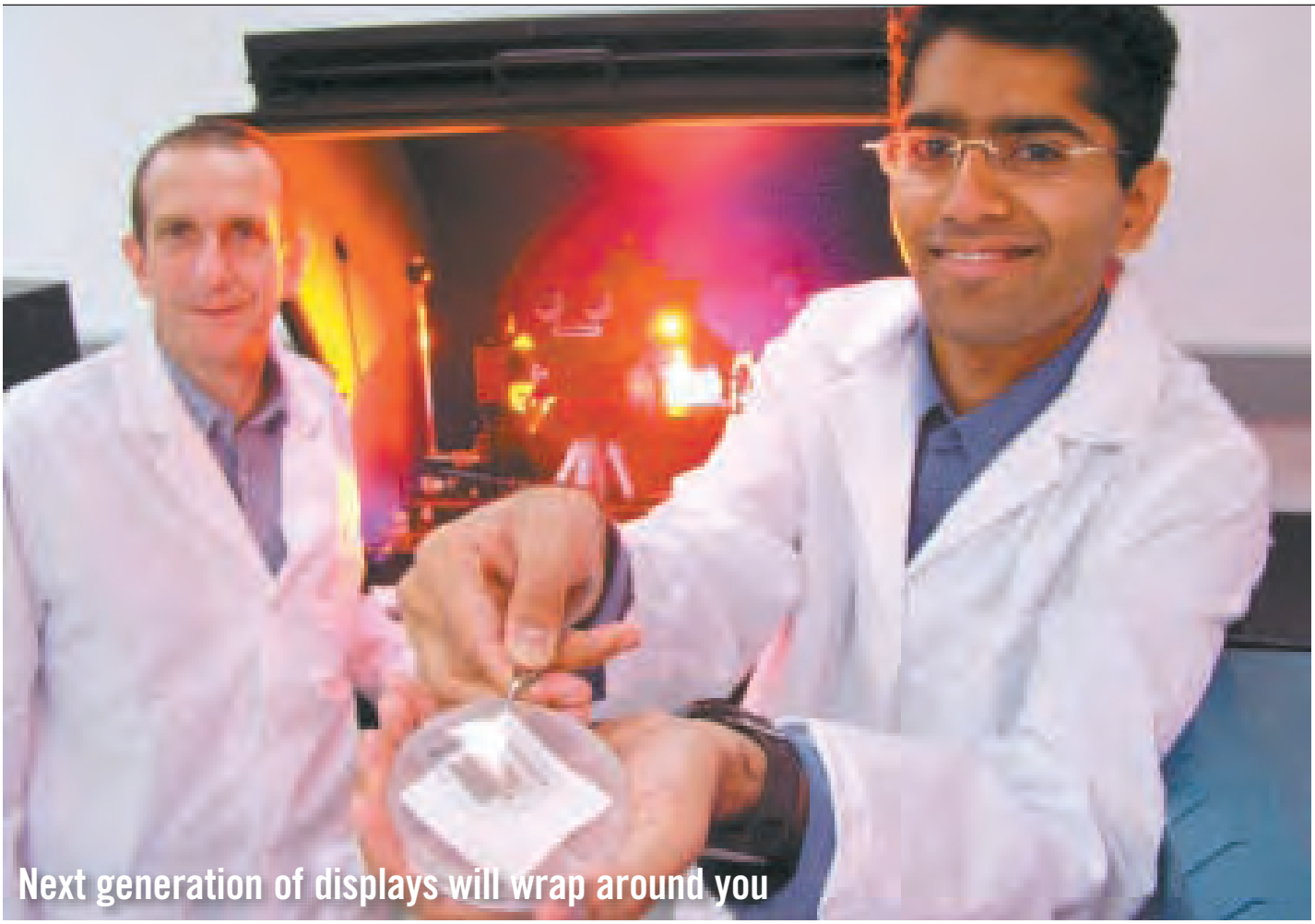

Next generation of displays will wrap around you

Imagined Reality

By Joe Kullman

Engineers Ed Bawolek and Sameer Venugopal conduct transistor performance measurements on flexible arrays used to drive displays.

Imagine a computer screen you can wrap around your wrist, or a cell phone or radio device that folds like a soft taco.

Imagine these instruments being lightweight but extremely durable, requiring only a small amount of power to operate and a relatively low cost to manufacture.

Researchers at the Flexible Display Center at Arizona State University are working to make such imagined information technology a reality.

In a 250,000-square-foot facility called the MacroTechnology Works at the ASU Research Park in Tempe, electrical, chemical and materials engineering, along with physics and chemistry, are being combined to accelerate the evolution of communications technologies.

The center was established in 2004 with a $43.7 million, five-year cooperative agreement between ASU and the Army Research Laboratory. It includes an option for an additional $50 million for a second five-year period.

In addition to acquiring the MacroTechnology Works facilities, ASU has contributed more than $8 million in pilot-line and lab equipment and other facilities.

Gregory Raupp, the center's director and a chemical engineering professor at ASU's Ira A. Fulton School of Engineering, leads a team of more than 30 personnel who are experimenting with various plastics and flexible metal foils to replace the rigid and often fragile glass screens now used for computers and other text- and image-display devices.

The research is aimed at providing the U.S. military with advances in energy-efficient, resilient, high-performance mobile information technology that will offer more reliable and effective battlefield communications.

At the same time, the goal is for the research to stimulate commercial applications in the consumer-electronics market. The center has 16 industry partners, with more expected to join.

Principal members include Honeywell International, EV Group, U.S. Display Consortium and Universal Display Corp. Associate and technology user members include Abbie Gregg Inc., Corning Inc., E Ink Corp., General Dynamics, ITO America Corp., Kent Displays Inc., L-3 Communications Corp, Litrex Corp., Nitto Denko Corp., Raytheon, Rockwell Collins Inc. and Surface Science Integration.

Princeton University, the University of Texas at Dallas and North Carolina A&T University are among the Flexible Display Center's institutional partners.

Industry partners support the center through membership dues, contributing expertise by providing personnel and resources for research and development projects, and providing avenues for commercialization of new technology.

The commercial applications are potentially vast. Any technologies that employ electronic view screens could be improved dramatically by the new developments, says Nick Colaneri, the center's associate director.

But the scientific challenges are extensive and the engineering problems are expensive to solve, he says.

"We are dealing with a sophisticated microelectronics circuit. In a small portable display there can be hundreds of thousands of transistors on a sheet of bendable plastic or stainless steel, and all of them need to function for the display to work properly," Colaneri says.

Barry O'Brien fabricates transistors on six-inch wafers using sputter deposition processing.

"With these technologies, any minor imperfection in a display is immediately perceptible. Near-perfect can be far from acceptable. Our challenge is to produce picture-perfect displays," he says.

ASU landed the Flexible Display Center after rigorous competition, vying against some of the nation's top research universities. The center gives ASU a singular distinction in the university research arena.

"Research is being done here that is not being done anywhere else in the Western Hemisphere," Colaneri says. "This is the only place doing work on such a large scale on what could be enormously important technology."

To date, the center's personnel have installed a functional 6-inch wafer-scale pilot line and are in the process of installing a GEN II-scale pilot line expected to be functional by the end of this year. Four-inch diagonal QVGA active matrix thin-film transistor backplanes are being designed and optimized for the various electro-optic technologies that the center's member companies provide. Processing on flexible materials has been initiated so that 4-inch flexible displays will be demonstrated later this year.

"Although the technological challenges are large, the benefits that will come from success will bring great rewards not only to ASU but to the economy of central Arizona," says Jonathan Fink, ASU's vice president of Research and Economic Affairs.

"This team of corporate, academic and government partners has a chance to position metro Phoenix as the single North American hub of an emerging group of multibillion-dollar industries," Fink says. "It's similar to the way in which Stanford and UC Berkeley helped the San Francisco Bay area benefit from the microprocessor technologies emerging from university and startup company laboratories in the 1970s."

The research also promises to significantly aid national security. General Dynamics is working with the center as part of its efforts as lead technology integrator for the Army's Future Force Warrior Program.

Flexible displays are to be a primary element in new technology arrays designed to improve combat effectiveness and battlefield survival, says Richard Coupland, senior manager of the program for General Dynamics.

General Dynamics plans to have the first flexible displays ready to demonstrate to the Army next year.

Says Coupland: "It's going to be a big leap forward." TC

Six-inch wafers with thin film transistor (TFT) arrays fabricated on ASU's 6-inch Pilot Line.

> "Our challenge is to produce picture-perfect displays."
>
> Nick Colaneri, associate director of the Flexible Display Center

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