MDA Update
Linking American Businesses to Missile Defense Technology
FALL 2003
ISSUE #47
www.mdatechnology.net

OPTOELECTRONICS

OPTODOT SEEKS ORGANIC FUTURE FOR OPTOELECTRONICS

Optodot Corporation (Allston, MA) has demonstrated the performance and miniaturization of organic semiconductor thin films necessary for future optoelectronic devices. The breakthrough materials technology ultimately could lead to organic optoelectronic circuitry—an essential building block for super-high-speed optical computers and networks.

In 2002, MDA awarded Optodot an SBIR Phase I contract to show that its proprietary organic semiconductor material could be used to build optoelectronic devices, including modulators.

Thin-film layers of anode and cathode materials on a substrate were created. Sandwiched between these layers was an active organic semiconductor region on the order of 1 micron. This area is roughly 700-times smaller than that found in indium phosphide modulators and 25,000-times smaller than that found in polymer-based and lithium niobate-based modulators. Tests of the material showed very high speeds, low energy photo-optic switching, low electro-optic switching voltages, low insertion loss, and excellent stability.

During this early research, Optodot made an unexpected discovery. Electro-oxidation of the organic semiconductor material causes it to change color and infrared transparency. This switching rapidly reverses in the dark. The same reversible color change was made to occur in response to ultraviolet light. This serendipitous effect has been exploited in the form of an organic semiconductor-based photochromic ink that could be used to tag products and documents with security marks that are virtually impossible to counterfeit (see page 7).

In 2003, under an MDA FasTrack SBIR Phase II contract, Optodot began work on developing prototype organic modulators and photo detectors. MDA funded this SBIR research because it may lead to smaller, faster, and cheaper computer chips in the future.

"We believe that organic semiconductors could provide the breakthrough materials technology for optoelectronic devices," said Dr. Steve Carlson, Optodot's president. "We envision a wide variety of military and commercial applications."

For example, organic modulator and photodetector devices would enable board-level optical interconnects that could alleviate the ever-tightening electrical interconnection bottleneck and could provide greater computational power for military and commercial uses. Integrated into a transceiver module, they could be used for free space and waveguide interconnections and for on-chip, inter-chip, inter-board, and inter-box connections.

These smaller, high performing organic modulator and photodetector devices also could be used in nonintegrated optical transceivers and optical interconnects for low-cost optical communications, particularly for metro/regional and local optical networks. Currently, over 90 percent of the modulators used in communication networks today are lithium niobate interferometric modulators, and they are much too large and expensive to meet the requirements and industry specifications for 10-GHz communications in metro and local applications.

Optodot is working with a large U.S.-based optoelectronics manufacturer to build organic modulator and photo-detector prototypes. Together, the two companies plan to commercialize this technology. Inquiries from potential customers are sought.

Optodot has significant financial backing to support its technology development efforts. Seed Capital Partners of Buffalo, NY, an early-stage investor affiliated with Japanese Internet investor Softbank, has invested over $1 million. CRE Investments also has made a sizable financial investment.

—P. Hartary

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On the bench. *Researchers at Optodot are developing organic semiconductor materials that could lead to organic optoelectronic circuitry. Tests of the materials show that active semiconductor regions can be reduced to about 1 micron.*