Scientists develop new materials for board-level photonics

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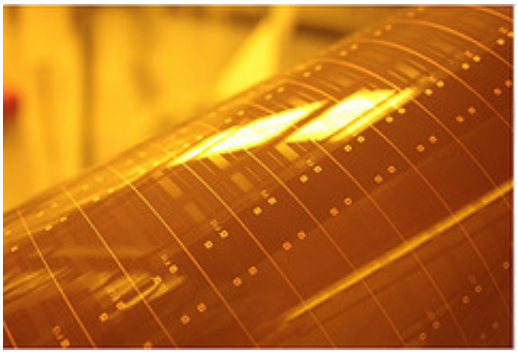

Today at the Photonics West conference, Dow Corning and IBM scientists unveiled a major step in photonics, using a new type of polymer material to transmit light instead of electrical signals within supercomputers and data centers. This new silicone-based material offers better physical properties, including robustness and flexibility, making them ideal for applications in Big Data and for the development of future exascale computers, which are capable of performing a billion billion computations per second.

With exabytes of structured and unstructured data growing annually at 60 percent, scientists have been researching a range of technological advancements to drastically reduce the energy required to move all that data from the processor to the printed circuit board within a computer.

Optical interconnect technology offers bandwidth and power efficiency advantages compared to established electrical signaling.

"Polymer waveguides provide an integrated means to route optical signals similar to how copper lines route electrical signals," explains Dr. Bert Jan Offrein, manager of the Photonics Research group at IBM Research. "Our design is highly flexible, resistant to high temperatures and has strong adhesion properties—these waveguides were designed with no compromises."

In a collaboration with Dow Corning, the scientists for the first time fabricated thin sheets of optical waveguide that show no curling and can bend to a 1 mm radius and is stable at extreme operating conditions including 85% humidity and 85°C. This new polymer, based on silicone materials, offers an optimized combination of properties for the integration in established electrical printed circuit board technology. In addition, the material can be fabricated into waveguides using conventional manufacturing techniques available today.

"Dow Corning's breakthrough polymer waveguide silicone has positioned us at the forefront of a new era in robust, data-rich computing, especially as we continue to collaborate with outstanding industry leaders like IBM," said Eric Peeters, vice president, Dow Corning Electronic Solutions. "Optical waveguides made from Dow Corning's silicone polymer technology offer customers revolutionary new options for transmitting data substantially faster, and with lower heat and energy consumption. We are confident that silicone-based board-level interconnects will quickly supersede conventional electronic signal distribution to deliver the amazing speeds needed for tomorrow's supercomputers."

A presentation (entitled "Stable and Easily Processable Optical Silicones for Low-Loss Polymer Waveguides") given here by Brandon Swatowski,

application engineer for Dow Corning Electronics Solutions, reported that fabrication of full waveguide builds can be completed in less than 45 minutes, and enable a high degree of process flexibility. Silicone polymer material, which is dispensed as a liquid, processes more quickly than competitive waveguide materials such as glass and does not require a controlled atmosphere chamber.

Swatowski's presentation went on to say that waveguide builds based on the silicone polymer showed excellent adhesion to polyimide substrates. He also discussed how optical characterization of the new polymer waveguides silicones showed losses as low as 0.03 dB/cm, with environmental stability extending past 2,000 hours exposure to high humidity and temperature, and good performance sustained over 500 thermal cycles between –40°C to 120°C.

Provided by IBM

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