CNSE develops innovative laser-enabled electronic packaging technology

November 18 2011

(PhysOrg.com) -- Small. Fast. Precise. A new electronics manufacturing technology developed at NDSU's Center for Nanoscale Science and Engineering eliminates challenges facing conventional packaging techniques and shows promise to significantly reduce the size and unit cost of microelectronic devices. The technology, called Laser-Enabled Advanced Packaging (LEAP), has the potential to enable high-volume handling, placement and interconnection of microelectronic components smaller than ever before possible.

CNSE researchers have successfully implemented the LEAP technology to fabricate the first-ever functional electronic device with a laser-assembled, ultra-thin silicon chip embedded in a flexible substrate. The research group is led by Val Marinov, associate professor of manufacturing engineering; and includes Orven Swenson, associate professor of physics at NDSU; graduate research assistants Ferdous Sarwar and Yuriy Atanasov; research engineer apprentice Ross Miller; Bernd Scholz, CNSE research engineer; and postdoctoral researcher Jingling Yan. Past participants in the research group include former CNSE research scientist Zhigang Chen, postdoctoral researcher Samali Datta, graduate research assistants Deyan Mihaylov and Sourin Bhattacharya, and undergraduate research assistant Matthew Semler.

The LEAP technology offers a new paradigm for numerous types of flexible and potentially disposable microelectronic devices, such as garment-integrated RFID tags, intelligent sensors platforms and self-adapting conformal antennas. "This technology has strong potential in

the near future outside of defense applications to reduce the unit cost of high volume single-chip devices such as RFID tags, smart cards, chip-and-pin bank cards and 'smart' bank notes," said Aaron Reinholz, associate director for electronics technology at CNSE.

A key part of LEAP is the patent-pending process, Thermo-Mechanical Selective Laser Assisted Die Transfer (tmSLADT). This process selectively and rapidly places ultra-thin semiconductor chips at specific locations and orientations with high precision. According to the researchers, no other high-volume techniques currently exist for the selective placement of such ultra-thin, flexible components essential to fabricate electronic devices on flexible substrates, with various types of active and passive embedded components. "These types of components are especially of interest for flex substrate electronics, as they allow devices to bend, roll and be manipulated into complex geometries," said Reinholz.

The LEAP technology is outlined in "Laser-Enabled Advanced Packaging of Ultrathin Bare Dice in Flexible Substrates" which has been accepted for publication by IEEE Transactions on Components, Packaging and Manufacturing Technology, manuscript TCPMT-2011-105.

Provided by North Dakota State University