DARPA Selects Lucent Technologies to Provide Nanotechnology For Advanced Military Systems

September 9 2004

Lucent to provide Ultra Dense Large Micro Electro Mechanical Systems Spatial Light Modulators for Maskless Lithography to DARPA

Lucent Technologies has been selected by the Defense Advanced Research Projects Agency (DARPA) to develop an advanced microsystem that will make the design, engineering and fabrication of next-generation advanced silicon integrated circuits faster, more economical and with increased security for military applications such as transformational communications and homeland security. The four-year contract, N66001-04-C-8028, was awarded by the Space and Naval Warfare Systems Center San Diego, and is valued at $9.5 million, including options.

Lucent will design, develop and demonstrate micro electro mechanical systems (MEMS)-based Spatial Light Modulators (SLMs) that will enable maskless optical lithography.

Lithography is the process of imprinting patterns on semiconductor materials used in integrated circuits. A pattern, or mask, unique for each circuit, is required. Masks are costly, and new masks are needed each time the circuit design has to be modified. In low-volume situations, mask fabrication can become a significant manufacturing cost. Maskless lithography process using MEMS-based SLMs allows manufactures to build circuits without the expense of individual masks. Lucent's unique

SLMs enable such circuits to achieve smaller critical dimensions with higher throughput.

The Bell Labs-developed MEMS SLM technology is made possible by advanced nanofabrication. The Lucent SLMs will contain10 times more individual movable micromirrors, or pixels, than currently available. Individual pixels will be five times smaller and 10 times faster. That means optical maskless lithography systems used in the fabrication of next generation microelectronics can have features as small as 50nm and high throughput.

A MEMS SLM approach makes it possible to manipulate light in ways not previously possible in the fabrication of microdevices. In Lucent's MEMS SLM containing 100 to 200 nanometer features, extremely small mirrors are packed in an integrated multi-megapixel array that reduces requirement for the projection optics needed to achieve small, 50nm, critical dimensions of the next generation integrated circuits. The lower demagnification required for the smaller mirrors allows for a larger image area with the same optical element sizes and projector numerical aperture. This enables throughput that is 10 to 50-times faster than using other current maskless lithography processes, resulting in efficient and cost-effective fabrication.

"One of the most critical barriers in the areas of maskless lithography is the development and implementation of the appropriate beam modulation technology," said Dave Bishop, vice president of nanotechnology research and president, NJ Nanotech Consortium at Bell Labs. "The micromirror technology Lucent is providing to DARPA is a giant leap forward in the area of advanced MEMS designed and engineering, and is being achieved by combining innovative design with our unique MEMS fabrication capability. We foresee this technology having positive impact on such critical areas as homeland security and military transformational communications. "

The Lucent team includes Corning Tropel Corporation, DuPont Photo Masks Inc, Lincoln Laboratories. The work is performed in close partnership with ASML.