Toward Next Chip Generation: Researchers Demonstrate Powerful EUV Light Source

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A University of Central Florida research team has made a substantial inroad toward establishing extreme ultraviolet light (EUV) as a primary power source for manufacturing the next generation of computer chips.

The team, led by Martin Richardson, university trustee chair and UCF's Northrop Grumman professor of X-Ray optics, successfully demonstrated for the first time an EUV light source with 30 times the power of previous recorded attempts – enough to power the stepper machines used to reproduce detailed circuitry images onto computer chips.

The successful use of EUV light for this purpose marks a milestone in an industry-wide effort to create the most efficient and cost-effective power source for the next generation of chip production. Chips are now manufactured using longer-wavelength ultraviolet light sources.

The UCF breakthrough came as a result of a collaboration between Richardson and Powerlase Ltd., a company based in England. The company provided UCF with a powerful Starlase laser to combine with the specialized laser plasma source technology that the UCF team has developed. The unique technology combines the high conversion of laser light to EUV and effectively eliminates the neutral and charged particles that are associated with existing EUV plasma sources. If allowed to stream freely away from the source, those particles can harm the expensive optics used in EUV steppers.

The short wavelength, only 13.5 nanometers, and an uncontaminated light source are critical components for the stepper's ability to project ever-smaller circuitry onto chips.

In order to keep up with Moore's Law, a computer industry dictum written in 1965 that estimates a doubling of the number of transistors on a computer chip about every two years, significant technological changes have to be made in chip production, Richardson said.

"We must use a light source with a wavelength short enough to allow the minimum feature size on a chip to go down to possibly as low as 12 nanometers," Richardson said. The current industry standard for semiconductor production is approximately 65 nanometers.

Richardson's EUV Photonics Laboratory, part of a broader effort on high-power laser applications that he runs, is focused on developing the EUV light source and advanced X-ray optical systems. Team members include graduate research assistant Kazu Takenoshita; graduate students Tobias Schmid, Simi George, Robert Bernath and Jose Cunado; and engineer Somak Teerawattanasook.

Research efforts have been aided by a 2004 donation of intellectual property and equipment valued in excess of $22 million to UCF's College of Optics and Photonics to support Richardson's EUV program.

Continued collaboration with industry groups such as Powerlase is allowing the work to advance exponentially, Richardson said.

"We are very excited to be able to collaborate with world-leading academic experts in the field of extreme ultraviolet sources," said Samir Ellwi, Powerlase's vice president of strategic innovations. "Our high-power, high-repetition short pulse Starlase laser is an ideal driver for the laser produced plasma EUV source."

Source: University of Central Florida

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