newsbreaks

Rare-earth-doped gallium nitride lases

Because rare-earth ions exhibit inner-shell transitions that produce sharp photoemission lines with wavelengths ranging from the UV to the near-IR, they can be used in solid-state lasers that are optically pumped and have an insulating host. To develop an electrically pumped rare-earth laser, however, semiconductor rather than insulator hosts are required. Scientists from the Nanoelectronics Laboratory of the University of Cincinnati (Cincinnati, OH) have demonstrated rare-earth-based lasing action in a semiconductor host.

Using molecular-beam epitaxy, europium (Eu)-doped gallium nitride was grown on a 10-mm-square sapphire substrate resulting in a 0.6-µm active layer doped with approximately 1 to 3 atomic percent Eu. After pumping the region with a nitrogen laser at 337.1 nm and blocking the surface emission, lasing was observed at the edge of the doped film at the dominant emission-peak wavelength of 620 nm at a threshold of 10 kW/cm^2. By increasing the pump power above threshold, the modal gain was measured to be 43 cm^{-1}. This low-threshold pump power and strong modal gain are promising indicators for achieving electrically pumped lasing from this material combination. *Contact Andrew J. Steckl at* a.steckl@uc.edu.

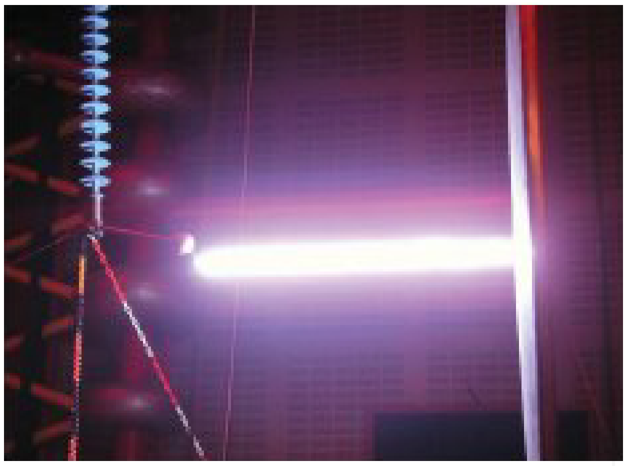
Polyimide smooths surface of EUV aspheric condensor

The reflective aspheric condensor (illumination) optics used for extreme-UV (EUV) lithographic systems are assailed by intense ionizing radiation, heat, and contaminants from outgassing, resulting in the need for frequent replacement. Because of this, cheaper optics are better, at least as long as quality remains good. Researchers at Lawrence Livermore National Laboratory (Livermore, CA) and Lawrence Berkeley National Laboratory (Berkeley, CA) have figured out how to produce aspheric optics for this purpose using the relatively inexpensive technique of diamond-turning, while keeping surface roughness down (the 2-nm finish of ordinary diamond-turned optics reduces EUV reflectance to only a few percent).

The surface of a diamond-turned aluminum ellipsoidal reflector was smoothed by spinning on a film of polyimide, which was then cured in an oven. A multilayer molybdenum/silicon reflective film was deposited over the polyimide; the multilayer had 80 bilayers and was 556 nm thick. The high-spatial-frequency roughness of the substrate was reduced from 1.76 to 0.27 nm root-mean-square without pushing surface slope beyond specifications. A test of the ellipsoid in an EUV system showed that the surface did not degrade more than a conventional reflective surface. *Contact Regina Soufli at* regina.soufli@llnl.gov.

Teramobile laser guides lightning through rain and clouds

Researchers in Germany and France at the Teramobile femtosecond-laser project have taken a step closer to the long-term goal of laser-guided lightning by successfully testing their system in simulated rain conditions. In 2001, the Teramobile, a 6-TW Ti:sapphire laser, was used to guide simulated lightning in the laboratory. The laser generated self-guided filaments that triggered and channeled high-voltage pulses across a 2.5-m gap from an electrode located at a pulse generator to a remote electrode connected to ground (see *Laser Focus World*, January 2002, p. 37).



Guiding real lightning, however, will also require operation through real atmospheric conditions, such as rain. So collaborators at the Freie Universität (Berlin, Germany), the Université Claude Bernard (Lyon, France), the Laboratoire d'Optique Appliquée (Palaiseau, France) and the Institut für Energie- und Automatisierungstechnik (Berlin, Germany) sprayed water droplets between the electrodes in their experiment at a flow rate of 1.4 mm/min to simulate atmospheric conditions of heavy rain, while the Teramobile provided 170-fs, 230-mJ pulses centered at 800 nm. They found that even in dense clouds, the pulse-guiding phenomena persisted despite interaction with large aerosol particles on the order of 0.5 mm in diameter. *Contact Jérôme Kasparian at* jkaspari@lasim.univ-lyon1.fr.