

Microlasing Demonstrated in Disordered Material

In a development that could prove to be significant for the future of integrated photonic circuits, researchers H. Cao, J.Y. Xu, E.W. Seelig, and R.P.H. Chang of Northwestern University have fabricated microlasers using micron-sized clusters of disordered ZnO nanoparticles. Whereas previously described methods of microlaser fabrication require expensive crystal-growth techniques, this one relies on inexpensive chemical-precipitation procedures.

For microlasing to occur, light must be confined to a volume whose dimensions approximate the optical wavelength. Research has been focused on highly ordered crystalline materials that could trap light between two distributed Bragg reflectors (vertical cavity surface emitting lasers), or utilize total internal reflection at the edge of high-index disks (microdisk lasers). In the study at Northwestern, however, the investigators took advantage of a phenomenon known as Anderson localization of light: In a highly disordered structure, the strong scattering and wave interference of light can result in a scatter-

ing mean free path of about half the optical wavelength, effectively trapping the photons.

As reported in the April 17 issue of *Applied Physics Letters*, ZnO nanocrystallites with an average size of 50 nm are synthesized by hydrolysis of a zinc salt in a polyol medium. Scanning electron microscope (SEM) images show that these nanocrystallites agglomerate in micron-sized clusters. When a single cluster is optically pumped at room temperature using a Nd:YAG laser, initially a single broad emission peak is observed. Increasing the pump energy above a threshold measured to be 0.2–0.3 nJ results in a sharp peak in the ultraviolet emission spectrum at about 380 nm. Simultaneous observation of the spatial distribution of the emitted light intensity in the sample cluster using an ultraviolet microscope shows the “localization cavity” to be a bright spot approximately 0.3 μm in diameter. Further increases in pumping power can produce additional emission peaks and bright spots as other cavities in the cluster begin lasing due to the Anderson localization phenomenon.

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The Minerals, Metals & Materials Society (TMS) has honored **Reza Abbaschian**, professor and chair of the University of Florida Department of Materials Science and Engineering; **Robert W. Cahn**, Distinguished Research Fellow at Cambridge University; **Lionel C. Kimerling**, Thomas Lord professor of materials science and engineering and the director of the Materials Processing Center at the Massachusetts Institute of Technology (MIT); **Subra Suresh**, R.P. Simmons Professor of materials science and engineering at MIT; and **Jeffrey Wadsworth**, deputy director for science and technology at the Lawrence Livermore National Laboratory, as TMS Fellows.

Abbaschian is recognized as an outstanding scientist and educator and a leading researcher in solidification fundamentals and materials processing. He earned his BS degree (1965) in mining engineering at the University of Tehran, Iran; his MS degree (1968) in metallurgical engineering from Michigan Technological University, Houghton; and his PhD degree (1971) in materials science and

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