Quantum Dots for Lasers and Microcavity Light Emitters

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Abstract:
Scaling of semiconductor devices to small sizes can result in the appearance of quantum phenomena that are not observed in larger devices. Such device scaling often times results in improved performance or even new functionality. For optoelectronic devices, it is now possible to obtain 3-dimensional quantum confinement both for optical modes and for electron-hole light emitters. In this talk we describe the use of selective oxidation of III-V heterostructures and other novel fabrication techniques to create lasers and microcavity light sources based on self-organized quantum dots. By combining the selectively oxidized microcavities with nanostructures, new types of GaAs-based microcavity lasers and light emitting diodes can be fabricated that impact today's fiber and free-space optical interconnects, and pave the way for a future optoelectronic technology based on the new quantum phenomena. We show that one of these phenomena, the Purcell effect, provides the basis for development of a new type of microcavity lasers with ideal characteristics for high density optical interconnects and fiber optics. In addition, self-organized quantum dots exhibit interesting dynamics in carrier relaxation and light emission, and experimental and theoretical work is underway to understand the relevant physics based on the new type of quantum dimensionality afforded by self-organized crystal growth.

Bio:
Dennis G. Deppe received the B.S. (1981), M.S. (1985), and Ph.D. (1988) degrees in electrical engineering from the University of Illinois at Champaign-Urbana. His Ph.D. thesis work studied atom diffusion in III-V semiconductor heterostructures, and its use in semiconductor laser fabrication. From 1982 to 1984, he was employed by Hewlett-Packard as a silicon integrated circuit engineer, and following his Ph.D. was employed as a Member of Technical Staff at AT&T Bell Laboratories in Murray Hill, New Jersey. He is presently a Professor in the Electrical and Computer Engineering Department at The University of Texas at Austin where he holds the Robert and Jane Mitchell Endowed Faculty Fellowship in Engineering. His research specialties include optoelectronics, laser physics, and quantum optics. He has received the Presidential Young Investigator Award from the National Science Foundation, the Young Investigator Award from the Office of Naval Research, the Nicholas Holonyak Jr. Award from the Optical Society of America (for development of the oxide-confined VCSEL), and is a Fellow of the IEEE and OSA. He has published over 180 journal articles and presented over 130 conference papers in areas of III-V optoelectronics, including numerous invited talks, and holds 6 patents. His research group at The University of Texas studies the epitaxial growth and fabrication of novel optoelectronic devices.

Date: Thursday, September 12th, 2002

Location: Arizona State University, Main Campus, Gold Water Center (GWC)
Room 487
Enter the facility through the main (south) lobby and take stairs to the fourth floor.
The conference room is on your right.

Time: 5:30-6:00pm Social/Refreshments, 6:00-7:00pm Presentation, 7:00pm Dinner (Pizza & soda are being provided by the WAD Phoenix Chapter)

For more information, please call Jon Candelaria at (480) 755-5460 or send email to jon.candelaria@motorola.com