NECP Nanoscale Engineering Certificate Program

Fall 2004 Seminar Series

Silicon Quantum Dot Devices

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Recent progress in the fabrication technology of silicon nanostructures has made possible electronic devices based on single electron tunneling, ballistic transport, visible photoluminescence and electron emission. Nanocrystalline silicon particles with diameter less than 10 nm have been prepared by VHF plasma-enhanced decomposition of silane gas. Pulsed gas plasma processing, in which the nucleation and the growth period are controlled precisely result in monodispersed nanocrystalline silicon particles.

Electrical properties of nanocrystalline silicon particles have been investigated by their incorporation into nanoscale electrodes resulting in Coulomb blockade oscillations of a single quantum dot. Single-electron memory effects are studied using a short channel MOSFET that use discrete Si quantum dots as a floating gate.

Visible photoluminescence and electron emission have been observed from surface oxidized nanocrystalline silicon particles. Efficiency of the no-phonon-assisted band emmision is enhances with decreasing core Si size. Electron emission efficiency from nanocrystalline Si based cold emitter device is seen to be as high as 5%, promising for display and lithography applications. A novel functional material NeoSilicon, is proposed, in which both quantum dot size and interparticle distance are precisely controlled.

Dr. Oda. Received his Ph.D. from Tokyo Institute of Technology in 1979 and was a post-doctoral fellow at MIT in 1982. He is a member of the Ministry of International Trade and Industry Committee of Industrial Technology as well as the Ministry of Education, Science, Sports and Culture Committee of Academic Research. He also serves as chair of the Association of Future Electron Devices

This NECP Seminar is jointly sponsored by the NECP program, by the CeNSE and the Departments of Chemical and Materials Engineering, and Electrical and Computer Engineering

Refreshments and pastries will be available before the seminar starts.

Friday, October 22, 2004
Physics/Chemistry Auditorium 155
University of Kentucky, Lexington, KY
12:00 – 1:00 pm