Nanostructure Integration Techniques for Manufacturable Devices, Circuits and Systems: Interfaces, Interconnects, and Nanosystems (SA112)

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Keynote Presentation by **Lars Samuelson,** Lunds Univ.

Nanotechnology promises the convergence of nano-electronics, nano-photonics, NEMS & MEMS structures, and other sensor components into single "intelligent" monolithic devices, possibly in 3D. However, despite significant progress in nanostructure synthesis (quantum dots, nanowires, etc.) and many promising single device demonstrations (such as FETs made with carbon nanotubes or nanowires) there are significant hurdles to realize such nanodevices, such as inability to controllably incorporate nano-sized components within integrated circuits, and to manufacture such devices with 5N or 6N reliability.

This conference will consider existing and new integration methods of nano-scale structures and devices with other nano-, micro-, and macro-scale electronic devices and circuits, as well as development of processes and fabrication techniques for nanoscale devices and electronics. The objective of this conference is to bring together experimentalists, theorists, computational specialists, and development engineers to provide an interdisciplinary forum to discuss the state-of-the-art of nano-materials and devices integration techniques. Areas of research that are particularly active include massively parallel techniques for the growth, fabrication and characterization of nano-structures, nanowires, nano-bridges, nanotubes, quantum dots, quantum wires, DNA, molecules and wafer level integration techniques. Furthermore, we must consider fast, reliable electrical testing of large numbers of nanostructures without resorting to nanoprobes or tedious and expensive serial interfacing. Several groups have developed/reported unique approaches of massively parallel 'in situ' techniques to integrate nanodevices in different semiconductor, metal and bio nano-material systems. Novel nano-electronic and nano-photonic devices are being designed and studied with a goal of making them an integral part of future nano-systems. Issues such as growth conditions, doping techniques and manufacturable wafer processing methods are among those that need more research.

This special meeting will be of interest to researchers in nano-sciences and technology. We hope to bring together researchers from a wide field of interest that include materials science, optics, physics, chemistry, biology, electrical engineering, etc.

1. Integration of 3D Confined Structures
a. Synthesis of quantum dots, nano-particles, 3D confined structures in various material systems
b. Templating and controlled growth.
c. Massively parallel fabrication and integration of 3D confined structures in circuits and systems.
d. Advanced topics including physical characteristics of nanoparticles as an individual and as an ensemble, precise positioning, electrical and optical characterization techniques.

2. Semiconductor Nanowires for Manufacturable Devices and Circuits: Synthesis, Doping, Device Fabrication and Integration
a. Novel nanowire based assemblies.
b. Manufacturable techniques for large array nanowire devices such as sensors, transistors, decoders and interconnects for nano-electronics.
c. Material and process issues with interfacing nano-scale devices.
d. Massively parallel fabrication of nanowire devices.
e. Precursors, catalysts and contact materials for compatible integrations, doping, and in-situ synthesis techniques.
f. Special orientation of materials and substrates for nano-synthesis.

3. Heterogeneous Integration
a. Heterogeneous synthesis of quantum dots and wires in different material systems.
b. Physics, theory, simulation, and modeling: theoretical limits of functional integrations.
c. Fabrication of nanodevices with heterogeneous materials: integration and applications issues.

4. Bioelectronic Structures and Integration
a. Electronic and photonic devices with biomolecules, DNA etc.
b. Biologically-assisted massively parallel nanofabrication.
c. New devices and systems that are hybrids of traditional polymeric and semiconductor materials with biological materials.
d. Single cell measurement with semiconductor and metallic nanostructures for disease diagnostics.
e. Bio-compatible nano-materials: requirements and current trends.
f. Bio-electronic interfaces.

5. Characterization Techniques for Integrated Nanostructures
a. Characterization techniques for interface evaluation, DC, RF and high frequency noise, high speed characterization of nanostructures.
b. Characterization of individual and an ensemble of nano-structures.
c. Novel photonic techniques for characterization.

6. Integration of Nanotubes
a. Novel nanotube growth and synthesis techniques for manufacturable devices and circuits.
b. Integration of nanotubes with conventional devices and circuits.
c. Evaluation of nanotube-substrate interfaces, structural and electrical characteristics of interface with metals, existing issues and integration of nanotubes with silicon microfabrication processes.

7. Advanced Topics in Nano-integrations
a. 3D integration of nano-devices and circuits.
b. Integrated systems with molecular logics and switching devices.
c. Integrated nanoemitter and receiver.
d. Nanostructure growth conditions, novel doping techniques and manufacturable wafer processing methods.
e. Application of advanced patterning techniques for precise positioning and dimension control of nanostructures.
f. Photonic crystal integration with active and passive devices.
g. Synthesis of new materials: semiconductors, dielectrics, polymers, superconductors, organics, magnetics, pyroelectrics, etc.
h. Novel characterization techniques for evaluating the optical, electrical, structural performance of integrated nanodevices.
i. Nanodevice integration with NEMS and NOEMS devices.
j. Nanodevices for in-situ bio-medical applications.

Abstract Due Date: 11 April 2005
Manuscript Due Date: 26 September 2005

Submission of Abstracts for *Optics East 2005* Symposium

Abstract Due Date: **11 April 2005** Manuscript Due Date: **26 September 2005**

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