ΙΤΕ/ΕΙΧΗΜΥΘ

ΣΕΜΙΝΑΡΙΟ

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ΘΕΜΑ: Transport Phenomena and Chemical Reactions Underlying the Metalorganic Vapor Phase Epitaxy of Compound Semiconductors

ΤΟΠΟΣ : Αίθουσα Σεμιναρίων ΕΙΧΗΜΥΘ

ΗΜΕΡΟΜΗΝΙΑ: 8 Οκτωβρίου 1999

ΩΡΑ: 13:00

ABSTRACT:

Metalorganic Vapor Phase Epitaxy (MOVPE) has emerged as the most versatile and cost effective technique for growing thin single-crystalline films and multilayer structures of compound semiconductors. These materials form the basis of advanced electronic and opto-electronic devices, such as field effect transistors and quantum-well lasers. MOVPE reactors are presently designed through expensive and time-consuming experimental trial and error and are operated with primitive or non-existent process control. Nevertheless, MOVPE has played a key role in the development of spectacular devices, such as the vertical cavity surface emitting lasers (VCSELs) which consist of more than 100 layers and require precise control of interface abruptness at the atomic level. The ultimate objective of our work is to understand the underlying physicochemical mechanisms of MOVPE and elucidate the link between processing conditions and film properties.

This presentation will introduce a hierarchical approach in modeling MOVPE systems ranging from atomistic to mesoscopic (feature) and macroscopic (reactor) scales as well as a model reduction strategy based on proper orthogonal decomposition. Fundamental reaction-transport models will be discussed describing the deposition of GaAs/AlAs structures and group III nitrides (GaN). A novel counterflow jet reactor will be introduced that can be used to study endothermic gas-phase reactions related to MOVPE in a wall-less environment and to synthesize semiconductor nanoparticles through gas-phase condensation reaction. Finally, results will be presented on the growth and characterization of (Zn,Fe)Se diluted magnetic semiconductor films for use in magneto-optical devices, such as optical isolators and modulators that can be tuned by an external magnetic field.