**MOCVD growth and characterization of nitride semiconductors for photovoltaics**

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An increasing research interest on photovoltaic application in InGaN-based alloys was driven by its favorable properties particularly the tunable direct band gap energy range of 0.70 (InN) to 3.4 eV (GaN) which spans most of solar spectrum. The InGaN has unique properties such as direct band gap, high absorption coefficient, high carrier mobility and high drift velocity for use in high temperature, and radiation resistance environment. It is possible to achieve >50% conversion efficiency with a hybrid InGaN-GaAs multijunction cell design. Apart from the solar cell application InGaN is attractive material for light emitting diodes, laser diodes, and photodetectors. However, fabrication of these devices has many challenges, particularly growth of high quality InGaN. The growth of In-rich InGaN is much more complicated by the fact that the mole fraction of indium incorporated in the film is not a simple function of the relative input flows of trimethyl indium (TMIn). The thermal decomposition of In-N bond and re-evaporation from surface leads indium segregation in the growth of InGaN.

Among the nitride alloy semiconductor structures used in various devices, AlInGaN epilayer can give more freedom in adjusting lattice constants and band gaps independently. The AlInGaN epilayer with an appropriate composition ratio can be grown as lattice matched to InGaN and can be used as electron blocking layer or window layer in solar cells. Therefore, the quaternary AlInGaN is a promising candidate towards enhancing electrical/optical confinement and minimizing mismatch-induced strain at the same time.

In the present lecture, MOCVD growth and characterization of InGaN/GaN quantum wells and AlInGaN/GaN will be presented. High resolution X-ray diffraction, photoluminescence, time resolved photoluminescence, Raman spectroscopy and atomic force microscopy have been employed to study the structural and optical properties of the heterostructures. The results are correlated with growth parameters and crystalline quality of the materials.