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Title of the thesis: “Growth and study of optoelectronic properties of a-Si:H/nc-Si:H based superlattice structures”

Abstract

Multilayer/superlattice structures of a-Si:H/nc-Si:H, show many interesting features such as enhanced carrier mobility and enhance photosensitivity etc. Superlattice structures based on amorphous layer have also been proposed as a novel transistor. Though a-Si:H/nc-Si:H superlattice structures show many interesting properties, the main challenge in superlattice structures based electronic devices is the interface states. These interface states between the sublayers act as recombination centers thereby controlling the transport mechanism and overall performance of the devices. In the present thesis, the influence of these interface states on electrical transport in a-Si:H/nc-Si:H multilayer structures has been studied using persistent photoconductivity (PPC) and SCLC measurements. No PPC was observed for the single layer films whereas, in case of multilayer films a significant amount of PPC(%) has been observed with higher DOS as compared to single layer films. Such superlattice structures also helped in the growth of controlled size Si nanocrystals in amorphous matrix, resulting in visible photoluminescence at room temperature without any post deposition processing. Nanocrystalline-amorphous Si superlattice offer a unique pathway for synthesizing embedded Si nanocrystals with controlled size and photonic signatures.