

Dielectric and Optical Properties of InP Quantum Dot Thin Films

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Semiconductor quantum dots are of great interest for both fundamental research and industrial applications due to their unique size dependant properties. The most promising application of colloidal semiconductor nanocrystals (quantum dots or QDs) is probably as emitters in biomedical labeling, LEDs, lasers etc. As compared to II-VI quantum dots, III-V have attracted greater interest owing to their less ionic lattice, larger exciton diameters and reduced toxicity. Among the III-V semiconductor quantum dots, Indium Phosphide (InP) is a popular material due to its bulk band gap of 1.35 (eV) which is responsible for the photoluminescence emission wavelength ranging from blue to near infra-red with change in size of QDs . Nevertheless, in recent years, the exact type of collective properties that arise when semiconductor quantum dots (QDs) are assembled into two- or three-dimensional arrays has drawn much interest. The term “quantum dot solids” is used to indicate three-dimensional assemblies of semiconductor QDs. The optoelectronic properties of the quantum dot solids are known to depend on the electronic structure of the individual quantum dot building blocks and on their electronic interactions.

This paper reports an efficient and rapid method to produce highly luminescent and monodisperse quantum dots solution and solid through fabrication of InP thin films. By varying the molar concentration of Indium to Ligand, QDs of different size were prepared .The absorption and emission behaviors were also studied. Similar measurements were also performed on InP quantum dot solid by fabricating InP thin films. The optical properties of the thin films are measured at different curing temperatures which show a blue shift with increase in temperature. The dielectric properties of the thin films were also investigated by Capacitance-voltage(C-V) measurements in a metal-insulator-semiconductor (MIS) device.