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TITLE

Formation of luminescent PbS coupled quantum dots

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We report on the preparation and luminescence response of PbS coupled quantum dots. If two quantum dots are separated by a distance of a few angstroms only then an electrical or chemical interaction can take place between them. This type of a pair of interacting quantum dots is called coupled quantum dots. The coupled quantum dot (QD) can behave as a weak-tunnel-coupling or covalent like coupling depending on the strength of the inter-dot coupling. Attempts have been made worldwide to connect two nearby QDs. The synthesis procedure of PbS coupled QDs in polymer matrix such as SBR latex is a simple nevertheless a cost effective and attractive approach. It is expected that excitons play a key-role in determining optoelectronic properties of coupled QDs. Evidence of quantum dot pairing, each of 10–18 nm size was evident by x-ray diffraction measurements and transmission electron microscopy studies. As a means of optical characterization, photoluminescence of the synthesized coupled QDs have been performed extensively. The synthesized coupled QDs emit in the range of visible to near IR of the electromagnetic spectrum. The basic exciton features in PbS coupled QDs at room temperature is explored through this study. It reveals excitonic peak position at ~570 nm which can be attributed to the combination of deep trap as well as shallow trap state and band edge recombination emission. The band edge exciton recombination might have subsided in this case as result of strong coupling between the QDs. Investigation of such coupled quantum dots would certainly find a potential scope in various optoelectronic and photonic device application. Along with PbS coupled QDs also exhibit an unique nature of photoluminescence where asymmetrically broadened intense exciton emission is noticed. The PbS QDs in the form of coupled dots can be useful as optical sensors which are based on the principle of photoluminescence. Promising exciton dynamics has also been shown in feasible optical switching mechanism. Increase in available number of excitons in PbS QD system could bring in the promise of population inversion as a means of active lasing component. The PbS coupled QDs can also be explored as qubits in quantum information network which has already received worldwide popularity.

Biography

Dr. Nabanita Dutta has completed her Ph.D.in Nanotechnology from Tezpur (Central) University, Assam, India for her thesis entitled “Optical Properties of Semiconductor Quantum dots, Interacting Quantum dots and Nano material filled SHI induced Ion tracks.” Currently, she is working as a post doctoral fellow (PDF) at Variable Energy Cyclotron Centre (VECC), Kolkata, India. She has published a couple of papers in reputed journals. Briefly her research interest deals with basically optical/ magnetic properties of semiconductor quantum dots, Homogeneous and heterogeneous coupled quantum dots, Sensitized solar cell, multifunctional materials such as Multiferroics having both ferromagnetic as well as ferroelectric properties. Nonlinear optics: nonlinear imaging with confocal microscopy, TPEF study, bioconjugation. Electrical properties, surface science, Solgel chemistry, Reverse micelles and Ion irradiation experiments.