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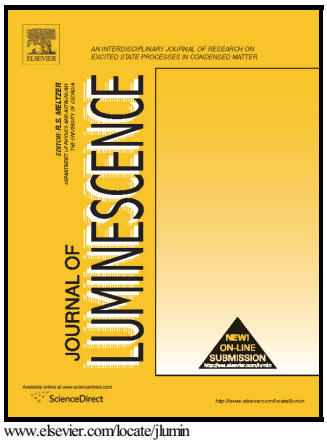

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Green synthesis of ZnSe and core-shell ZnSe@ZnS nanocrystals (NCs) using a new, rapid and room temperature photochemical approach

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Abstract

In this work, ZnSe and core-shell ZnSe@ZnS nanocrystals (NCs) were synthesized using a one pot, rapid and room temperature photochemical method. UV illumination provided the required energy for the chemical reactions. Synthesized NCs were characterized using X-ray diffraction spectroscopy (XRD), transmission electron microscopy (TEM), UV-Vis and photoluminescence (PL) spectroscopy. XRD pattern indicated cubic zinc blende structure for ZnSe NCs and the TEM image indicated round-shaped particles, most of which had the diameter of about 3 nm. Band gap of ZnSe NCs was obtained as about 3.6 eV, which was decreased by increasing the illumination time. Synthesized NCs indicated intensive and narrow emission in the UV-blue area (370 nm) related to the excitonic recombination and a broad band emission with a peak located at about 490 nm originated from the DAP (donor-acceptor pairs) recombination. ZnS shell was grown on ZnSe cores using a reaction based on the photo sensitivity of $Na_2S_2O_3$. For ZnSe@ZnS core-shell NCs, XRD diffraction peaks shifted to higher angles. TEM image indicated a shell around cores and most of the ZnSe@ZnS NCs have a diameter of about 5 nm. After the ZnS growth, ZnSe excitonic emission shifted to the longer wavelength and PL intensity was increased considerably. PL QY was obtained about 11% and 17% for ZnSe and ZnSe@ZnS core-shell QDs respectively.