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Controlled Growth of ZnO QDs by Wet Chemical Technique

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Abstract:

Zinc oxide quantum dots (ZnO QDs) were synthesized using the alcoholic solution of zinc acetate dihydrate at room temperature. Tetraethyl orthosilicate (TEOS) has been used as capping agent to control the particle size and uniform dispersion of quantum dots in the solution. We observed that the TEOS has effectively capped the ZnO QDs. The ZnO QDs were characterized using X-ray diffraction (XRD), field-emission scanning electron microscopy (FESEM), UV-visible spectrometry, photoluminescence (PL) and fourier transform infrared (FTIR) spectroscopy. XRD analysis revealed a single phase, wurtzite (hexagonal) crystal structure of ZnO QDs. The particle size estimated by Scherrer classical relation was found to be in between 9 nm and 5 nm for the samples prepared without and with TEOS. FESEM images of ZnO QDs reveal that the particles are spherical in shape, of size approximately 5 to 9 nm. The systematic blue shift in the optical spectra has been recorded with increasing the contents of TEOS in the growth matrix. The fundamental band edge transition observed in the excitation spectra was also found to be blue shifted systematically with increasing TEOS concentration. The high intensity peak attributed at ~520 nm in the emission spectra is defect associated to either Zn or O vacancies.

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