Photoluminescence properties of MoS_2 quantum dots synthesized by one-step hydrothermal method

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Quantum Dots (QDs) are nanocrystal semiconductors that is so small to consider as dimensionless. These have unique optical and electrical properties which makes them a potential candidate in the field of optoelectronic and bio-imaging applications. QDs are optically active from ultraviolet to near infrared portion of the electromagnetic spectrum and show size dependent photoluminescence phenomena. Due to this, it is possible to produce white light by mixing QDs of same material having different particle sizes. The QDLEDs are getting much attention due to the improved colour saturation, high colour rendering index and stability. Recently two dimensional (2D) transitional metal dichalcogenides (TMDC) are attracted much attention due to their non toxicity, tunable optical band gap and stability which make them suitable candidate in the field of photovoltaic, photonics, bio-sensing and bio-imaging application. Among the TMDC family, MoS_2 got enormous attention due to its layered structure and direct band gap properties.

The MoS_2 quantum dots were synthesized by low cost one step hydrothermal method. In this work, ammonium tetrathiomolybdate $(NH_4)_2MoS_4$ was used as a source of Mo and S. Hydrazine hydrate was used as reducing reagent. The optical and structural properties of MoS_2 quantum dots were investigated by PL, UV-Vis, FTIR and TEM measurements. MoS_2 quantum dots show blue emission. It also exhibits excitation dependent emission properties due to polydispersion of QDs as evident from colour co-ordinate diagram. The UV-Vis spectrum exhibits strong blue shift due to quantum confinement effect. The band gap value of the quantum dot is much larger than the bulk MoS_2. The functional group present in MoS_2 quantum dot was confirmed by FTIR spectroscopy. The particle size of quantum dots was calculated by TEM measurement.

Keywords: Quantum dot, Photoluminescence, Optical properties

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