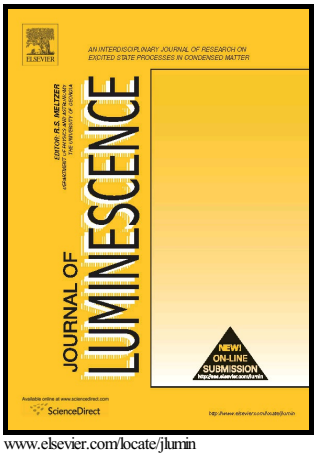

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Akanksha Singh, Chavvi Sharma, Mahesh Sharma, Reena Kumari, Ritu Srivastava, Shailesh Narain Sharma

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Enhanced Luminescence Efficiency of Wet Chemical Route Synthesized InP-based Quantum Dots by a Novel Method: Probing the Humidity Sensing Properties

Akanksha Singh[1,2], Chavvi Sharma[2], Mahesh Sharma[2], Reena Kumari[1], Ritu Srivastava[1] and Shailesh Narain Sharma[1,2]*

[1]Advanced Material and Devices Division, National Physical Laboratory, CSIR, New Delhi, India-110012.

[2]Academy of Scientific and Innovative Research (AcSIR), CSIR NPL, New Delhi, India.

*Email: shailesh@mail.nplindia.org

Abstract

In indium phosphide quantum dots(InP QDs), the presence of surface states due to unbonded indium or phosphorus atoms quenches its photoluminescence (PL) efficiencies. Hence, it is imperative to passivate these surface states to achieve high photoluminescence efficiencies of InP nanocrystals. In this work, a novel post-synthesis nascent H chemical treatment to enhance the quantum yield of single-pot, wet chemical route synthesized InP QD'sisreported for the first time. The main advantages of this post-synthesis treatment are: (i) it is easy, inexpensive and reproducible and (ii) it does not involve harsh chemical treatment viz. dipping of InP QDs in HF-based solutions, nor it requires annealing at high temperatures which may be detrimental to the fragile structure of InP. The significant increment in PL intensity upon aforementioned hydrogen treatment is due to the passivation of surface states and structural recrystallization mechanism that promotes radiative recombination of electrons and holes and hence higher lifetime values. An enhancement in PL intensity of as-synthesized InP QDs upon nascent hydrogen treatment is quite remarkable and is even better than that accomplished by InP-ZnS core-shell QDs with similar size-distribution. The hydrophobicity of H-treated InP QD's is found to be more than untreated InP thus implying higher compactness and structural rigidity similar to as achieved by InP-ZnS core-shell QDs. Mechanisms related to nascent hydrogen treatment, photo-oxidation and PL enhancement and