

Photoluminescence from cold all-inorganic perovskite nanocrystals

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Abstract

Despite the recent popularity and interest in all-inorganic perovskite nanocrystals (CsPbX_3 , $X=\text{Cl}$, Br , I NCs), the exact photoluminescence (PL) processes are still a mystery. By cooling the NCs to cryogenic temperatures heat-driven processes will disappear, opening up the possibility to investigate fundamental PL processes. PL Measurements of CsPbX_3 NCs at cryogenic temperatures have been reported widely, but the observed PL trends are not always the same and the interpretation varies. In this work results from temperature-dependent steady-state and time resolved PL are presented and analyzed. Besides measurements on NC ensembles, PL from single dots at low temperature is explored using micro PL spectroscopy. Connection of the results from the different experiments and comparison with literature yields an overview of the possible fundamental processes and likeliness. Thermal expansion, longitudinal optical phonon coupling, defect related emission and quantum dots turning off have all been identified as possibilities. Further understanding can improve CsPbX_3 NC's applicability for photovoltaics, light emitting devices and other optoelectronic devices.