Expanding Perovskite Toolbox via Self-Assembly of $CsPbX_3$ and Cs_4PbX_6 Nanocrystals

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In this contribution we will discuss current trends in perovskites from the perspective of nanocrystals-based bottom-up fabrication together with our results in making micron-sized nanocrystal superlattices and their chemical transformations. Self-assembly is a cheap bottom-up technique to fabricate inorganic solids from colloidal nanocrystals.[1] There are two advantages of using nanocrystals: 1) the spatial composition of the solid can be modified in three-dimensions within 10-20 nm by starting from a mixture of different nanocrystals (such composition control is inaccessible or prohibitively expensive by more traditional methods like epitaxy); 2) the collective interactions between ordered nanocrystals may lead to enhanced or unique physical properties of the solid. Lead halide-based perovskites prepared in the form of colloidal nanocrystals have emerged in the past few years as one of the most promising materials for solution-processed light emitters and photovoltaics.[2] Fast advances in the synthesis made samples of monodisperse nanocrystals of 3D $CsPbX_3$ and 0D Cs_4PbX_6 readily available.[3, 4] In addition, chemically-triggered interconversions between these phases at the nanoscale (0D↔3D) provide novel means of modulating composition and properties of the resulting solid. [5]

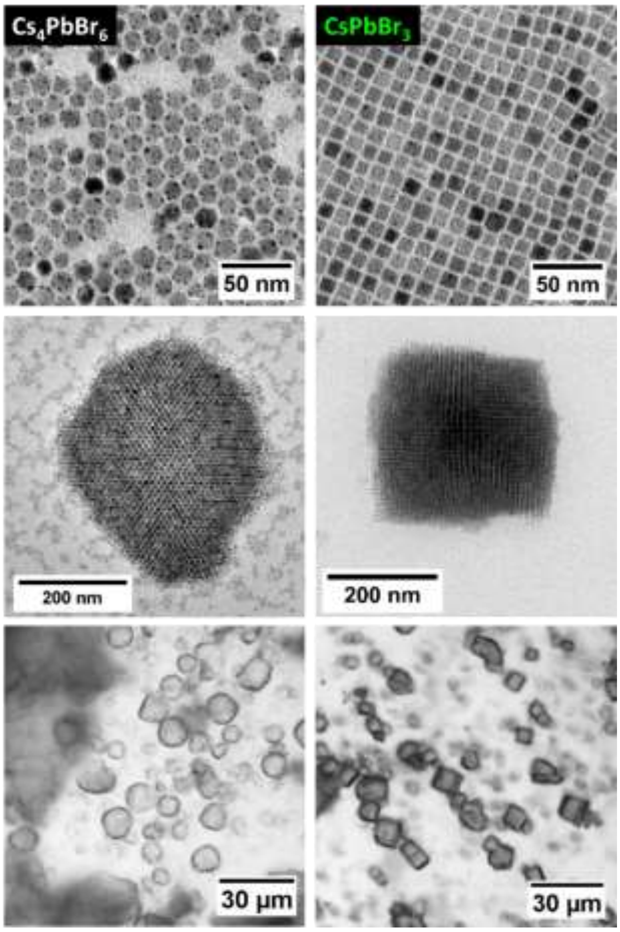

Figure 1. Various length scales of lead halide-based perovskite nanocrystals self-assembly. From monolayers to micron-sized crystals: left column – 0D phase Cs_4PbBr_6 nanocrystals, right column – 3D $CsPbBr_3$ nanocrystals.

References

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[5] Palazon et al, *ACS Energy Lett.*, 2, 2368-2377, 2017