Halide Perovskites Nanocrystals: Synthesis, Transformations and their Application in Devices

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Halide perovskite semiconductors can merge the highly efficient operational principles of conventional inorganic semiconductors with the low-temperature solution processability of emerging organic and hybrid materials, offering a promising route towards cheaply generating electricity as well as light. Perovskites not only show exceptional primary optoelectronic properties such as a direct bandgap, small exciton binding energy, low carrier recombination rates, ambipolar transport, and tunability of the bandgap covering a wavelength range from the near-infrared to the ultraviolet, but they are also very attractive for their ease of processability for mass production (e.g. printing from solution) and for the large availability of their chemical components. Following a surge of interest in this class of materials, research on halide perovskite nanocrystals as well has gathered momentum in the last three years. In such a narrow time span, several properties/features of halide perovskite nanocrystals were investigated, among them electroluminescence, lasing, anion-exchange, as well as control of size and shape such that nanocrystals in the quantum confinement regime were recently reported. The present talk will highlight the research activities of our group on halide perovskite and perovskite-related nanocrystals, with emphasis on synthesis, as well as structural, chemical, and surface transformations, and their applications in various types of devices.[1-3]

Figures

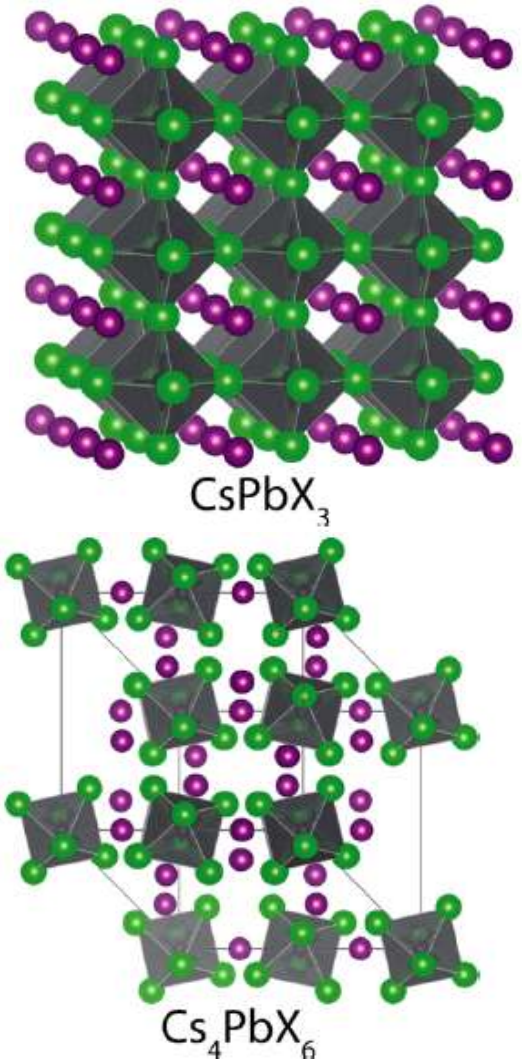

Figure 1. Crystal structure of $CsPbBr_3$ (top) and Cs_4PbBr_6 (bottom).

References

[1] Akkerman, Q. A. et al., Nat. Energy 2016, 2, 16194.
[2] Imran, M. et al., J. Am. Chem. Soc. 2018, 140, 2656-2664
[3] Akkerman, Q. A. et al., Nat. Mater. 2018, 17, 394-405