

Colloidal APbX₃ nanocrystals [A=Cs⁺, CH₃NH₃⁺, CH(NH₂)₂⁺] with bright photoluminescence spanning from ultraviolet to near-infrared spectral regions*Maksym V. Kovalenko**ETH Zürich, Department of Chemistry and Applied Biosciences, CH-8093, Zurich, Switzerland**and Empa-Swiss Federal Laboratories for Materials Science and Technology, CH-8600, Dübendorf, Switzerland*

Chemically synthesized inorganic nanocrystals (NCs) are considered to be promising building blocks for a broad spectrum of applications including electronic, thermoelectric, and photovoltaic devices. We have synthesized monodisperse colloidal nanocubes (4-15 nm edge lengths) of fully inorganic cesium lead halide perovskites (CsPbX₃, X=Cl, Br, and I or mixed halide systems Cl/Br and Br/I) using inexpensive commercial precursors [1]. Their bandgap energies and emission spectra are readily tunable over the entire visible spectral region of 410-700 nm. The photoluminescence of CsPbX₃ NCs is characterized by narrow emission line-widths of 12-42 nm, wide color gamut covering up to 140% of the NTSC color standard, high quantum yields of up to 90% and also low thresholds for stimulated emission [2]. Post-synthetic chemical transformations of colloidal NCs, such as ion-exchange reactions, provide an avenue to compositional fine tuning or to otherwise inaccessible materials and morphologies [3]. Similar synthesis methodologies are well suited also for hybrid perovskite nanocrystals based on methylammonium (MA) and formamidinium cations (FA): MAPbX₃ [4], FAPbBr₃ [5], Cs_{1-x}FA_xPbI₃ and FAPbI₃ [6]. In particular, Cs- and FA-based NCs (Figure below) are highly promising for luminescence downconversion (bright and narrow emission at 530 and 640 nm), for infrared light-emitting diodes and as precursors/inks for perovskite solar cells. In this talk, we will discuss the synthesis methodologies and optical properties of these novel APbX₃ NCs.



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3. S. Yakunin *et al.* Nature Communications **2015**, *9*, 8056.
4. O. Vybornyi *et al.* Nanoscale **2016**, *8*, 6278-6283
5. L. Protesescu *et al.* J. Am. Chem. Soc. **2016**, *138*, 14202–14205
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