Water Resistant $CsPbX_3$ Nanocrysals Coated by Polyhedral Oligomeric Silsesquioxane and Their Use in Light-emitting Devices

He Huang,[1] Bingkun Chen,[1,2] Zhenguang Wang,[1] Andrei S. Susha,[1] Haizheng Zhong,[2] and Andrey L. Rogach[1]

1. Department of Physics and Materials Science and Centre for Functional Photonics (CFP), City University of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong;
2. Beijing Key Laboratory of Nanophotonics and Ultrafine Optoelectronic Systems, School of Materials Science & Engineering, Beijing Institute of Technology, Beijing, 100081, China.

Last few years have seen a burst of publications on the perovskites in the form of colloidal nanocrystals (NCs). All-inorganic $CsPbX_3$ NCs, which exhibit both compositional and size variability of their bandgaps over the whole visible spectral range have been reported [1].

We demonstrate advantageous properties of $CsPbX_3$ (X=Br or I) perovskite NCs coated by Polyhedral Oligomeric Silsesquioxane (POSS): a high resistivity to water and the prevention of mixed perovskite NC powders of different halide composition from anion exchange both in water and in solid state [2]. The strong emission and the spectral shape of the POSS-coated perovskite NCs were fully preserved in powdered state, which allowed us to use them as solid state luminophores for fabrication of all-perovskite down-conversion white light-emitting devices (LEDs) [2]. In order to fabricate all-perovskite based white LEDs, green emissive $CsPbBr_3$ and red emissive $CsPb(Br/I)_3$ NCs were dispersed in a silicone resin, following by deposition onto a blue-emitting LED chip.

The beneficial role of the insulating material POSS as a solution additive or an additional hole-blocking layer to enhance the performance of electroluminescent green LEDs based on $CsPbBr_3$ perovskite nanocrystals has also been demonstrated [3]. POSS improved the surface coverage and the morphological features of the films deposited either from supernatant or suspension of perovskite nanocrystals. The POSS film acted as a hole-blocking layer between the perovskite nanocrystals and TPBi, keeping both electrons and holes located within the active layer for an efficient recombination.

1) L. Protesescu *et al.*, *Nano Lett.*, **2015**, 15, 3692-3696.
2) H. Huang *et al.*, *Chem. Sci.,* **2016**, 7, 5699-5703.
3) H. Huang *et al.*, *J. Phys. Chem*. Lett. **2016**, 7, 4398−4404