Organic Amphiphile as a Surface Ligand for Stable Caesium Lead Bromide Nanocrystals.

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Abstract:

Lead halide perovskite nanocrystals (NCs) have drawn a great attention in the recent years due to their outstanding properties which makes it suitable for various optoelectronic applications such as photodetectors, light emitting diodes and photovoltaics.[1] Here, we have synthesized and implemented a surface ligand for the surface treatment and colloidal stability of $CsPbBr_3$ NCs. The synthesis of the ligand is performed via the nucleophilic substitution reaction to obtain the pure ligand, which is subsequently engaged for stable and brightly luminescent $CsPbBr_3$ nanocrystal synthesis using the post-synthesis ligand exchange technique at room temperature.[2] This results in the perovskite NCs with > 90% photoluminescence quantum yield (PLQY), along with improved colloidal stability at ambient conditions for a period of four months.[2] In addition, we have fabricated the perovskite LEDs based on the new ligand treated $CsPbBr_3$ nanocrystals that exhibits maximum external quantum efficiencies of (EQE) of 17%.[3] The surface treatment with the newly synthesized ligand shows an effective way to produce high quality and stable perovskite nanocrystals for optoelectronic applications.

References:

1. Huang, He, et al. "Colloidal lead halide perovskite nanocrystals: synthesis, optical properties and applications." *NPG Asia Materials* 8.11 (2016): e328-e328.
2. Imran, Muhammad, et al. "Simultaneous cationic and anionic ligand exchange for colloidally stable $CsPbBr_3$ nanocrystals." *ACS Energy Letters* 4.4 (2019): 819-824.
3. Dai, Jinfei, et al. "Partial Ligand Stripping from $CsPbBr_3$ Nanocrystals Improves Their Performance in Light-Emitting Diodes." *ACS Applied Materials & Interfaces* 16.9 (2024): 11627-11636.