Photon Reabsorption in Mixed CsPbCl3:CsPbI3 Perovskite Nanocrystal Films for Light-Emitting Diodes

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Cesium lead halide nanocrystals, $CsPbX_3$ (X = Cl, Br, I), exhibit photoluminescence quantum efficiencies approaching 100% without the core-shell structures usually used in conventional semiconductor nanocrystals. These high photoluminescence efficiencies make these crystals ideal candidates for light-emitting diodes (LEDs). However, due to the large surface area to volume ratio, halogen exchange between perovskite nanocrystals of different compositions occurs rapidly, which is one of the limiting factors for white-light applications requiring a mixture of different crystal compositions to achieve a broad emission spectrum. Here, we report significantly reduced halide exchange between chloride and iodide $CsPbX_3$ (X= Cl, I) perovskite nanocrystals. We investigate samples containing mixtures of perovskite nanocrystals with different compositions, and study the resulting optical and electrical interactions. We report excitation transfer from $CsPbCl_3$ to $CsPbI_3$ in solution and within a polymethylmethacrylate (PMMA) matrix via photon reabsorption, which also occurs in electrically excited crystals in bulk heterojunction LEDs.

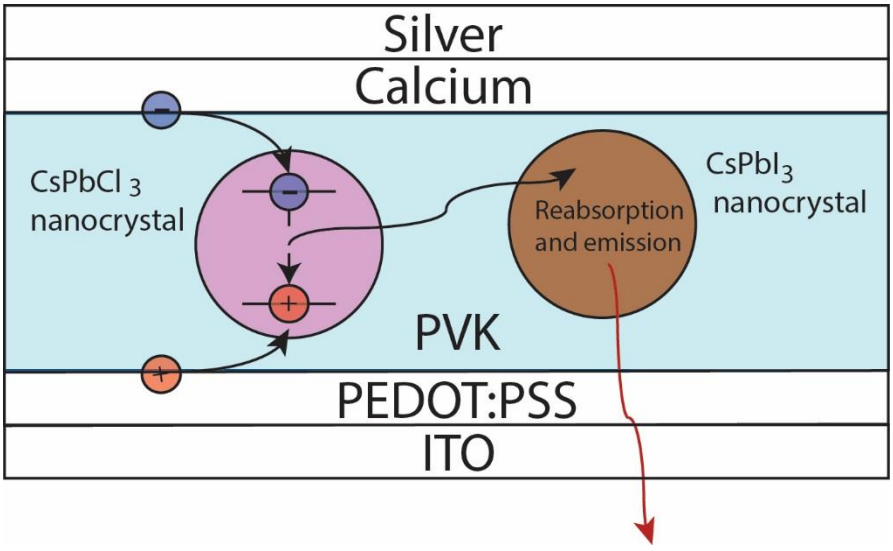

Fig. 1. Diagramtic Sturcture and operation of excitation transfer in bulk heterojunction LEDs