Perovskite Nanostructures as LEDs: Towards Flexible Displays

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Light Emitting Diode (LED) displays recently become to replace conventional CRT and LCD displays and have witnessed enormous growth in the field with the costs of LED displays decreasing by the day. Numerous studies are on-going for the next generation of displays that are flexible. There is an immediate need to design and develop novel materials that can be made flexible and provide vivid color purity throughout the entire visible region with greater luminescence efficiencies. In recent years, perovskite materials have gained enormous research attention as they have shown highest solar cell efficiencies (~22%) and also have the potential to made flexible. Perovskites have the advantage in having low exciton binding energies, ease of fabrication and excellent photo-stability. At the nanoscale, these perovskites have shown increased exciton binding energies that make them suitable for LED applications and thus we propose to use the advantages of perovskites to develop LED displays that are flexible. Using a hot-injection method, we synthesized different CsPbX3 (X=Cl, Br, I) nanomaterials that yielded photoluminescence throughout the visible spectrum. Under TEM scans, it was determined that the sizes of the perovskites are approximately 10 nm. To fabricate LED displays, interaction of perovskites with different polymer structures were studied and two different geometries of LEDs were fabricated. Perovskite/PDMS nanocomposite was found to be the best material to make LED displays. The results have shown bulk-heterojunction approach can lead to enhanced luminescence intensities when compared to layer by layer approach.