The Energy Applications of 2D Halide Perovskites

Hemamala Karunadasa

Stanford University, Stanford, United States

hemamala@stanford.edu

The 3D lead-iodide perovskites have recently been identified as low-cost absorbers for high-efficiency solar cells. Although the efficiencies of devices with perovskite absorbers have risen at an impressive rate, the materials' intrinsic instability may impede their commercialization. We found that their 2D derivatives, with **thick** inorganic sheets (Figure 1), served as absorbers with enhanced stability, allowing devices to be fabricated in air [1-2]. We also discovered that certain 2D perovskites with **thin** inorganic sheets (Figure 2) emitted broadband white light (similar to sunlight) when excited by UV light [3-5]. I will discuss how these materials, which do not contain extrinsic dopants or obvious emissive sites, could emit every color of visible light, which is promising for artificial illumination. Photogenerated carriers in 2D perovskites may form free carriers, free excitons, or self-trapped excitons. I will present our understanding of how synthetic design can control the fate of photogenerated carriers in 2D perovskites.

References

[1] Smith, Hoke, Solis-Ibarra, McGehee, Karunadasa, Angewandte Chemie, 53 (2014) 11232
[2] Slavney, Smaha, Smith, Jaffe, Umeyama, Karunadasa, Inorg. Chem., 56 (2017) 46 (Perspective)
[3] Dohner, Hoke, Karunadasa, JACS, 136 (2014) 1718
[4] Dohner, Jaffe, Bradshaw, Karunadasa, JACS, 136 (2014) 13154
[5] Smith, Karunadasa, Acc. Chem. Res. 51 (2018) 619 (Perspective)

Figures

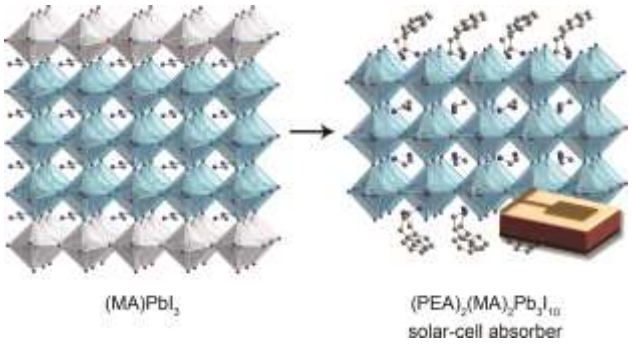

Figure 1: Derivation of 2D perovskite solar-cell absorbers; MA = $CH_3NH_3^+$, PEA = $C_6H_5(CH_2)_2NH_3^+$ [1-2]

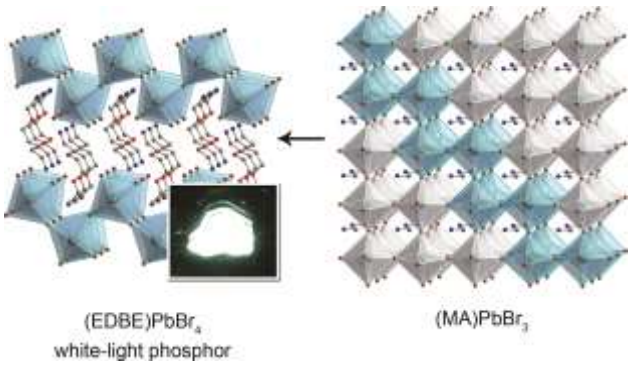

Figure 2: Derivation of 2D perovskite white-light emitters; EDBE = $^+H_3N(CH_2)_2O(CH_2)_2O(CH_2)_2NH_3^+$ [3-5]