

## 2-dimensional hybrid perovskites activation with an organic luminophore for photovoltaic applications.

K. Jemli,<sup>a,b</sup> F. Lédée,<sup>a,b</sup> P. Audebert,<sup>a</sup> L. Galmiche,<sup>a</sup> G. Trippé-Allard,<sup>b</sup> D. Garrot,<sup>c</sup> J.-S. Lauret,<sup>b</sup> and E. Deleporte<sup>b</sup>

<sup>a</sup> Laboratoire de Photophysique et Photochimie Supramoléculaires et Macromoléculaires, Ecole Normale Supérieure de Cachan, 61 avenue du Président Wilson, 94235 Cachan, France

<sup>b</sup> Laboratoire Aimé Cotton, Ecole Normale Supérieure de Cachan, CNRS, Université Paris-Sud, Bât 505 Campus d'Orsay, 91405 Orsay, France

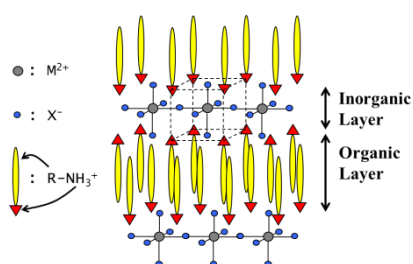
<sup>c</sup> Groupe d'Etudes de la Matière Condensée (GEMaC), CNRS, Université de Versailles Saint-Quentin-en-Yvelines, 45 Avenue des Etats-Unis 78035 Versailles cedex, France.

ferdinand.ledee@ens-cachan.fr

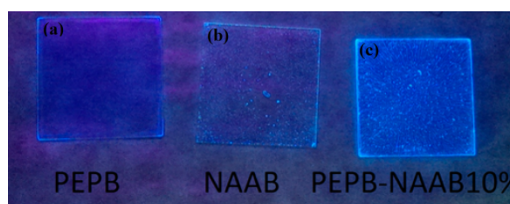
The excellent optical and electronic properties of hybrid organic-inorganic perovskites make them suitable active materials for optoelectronics devices. Here we focus the attention on the 2D lead halide hybrid perovskites having the general formula  $(\text{RNH}_3)_2\text{PbX}_4$  (figure 1). These self-assembled layered materials are particularly interesting for light emitting devices such as LEDs and Lasers. More recently, Smith et al have shown that 2D perovskites can be used as an active material in hybrid perovskite solar cells (PSCs) <sup>1</sup>. Compared to 3D lead halide hybrid perovskites  $(\text{RNH}_3)\text{PbX}_3$  these materials present a higher long-term stability, which is one of the main issue that hinders PSCs development in an industrial scale.

A great advantage of 2D perovskites is their better chemical flexibility and tunability with respect to 3D perovskites <sup>2</sup>. Here an adequately chosen luminophore has been introduced inside a lead bromide hybrid perovskite to improve light-harvesting and brilliance. In figure 2, we see that the functionalized perovskite exhibits a much higher brilliance than the standard one, while respecting the 2D perovskite structure <sup>3</sup>. The increase of the brilliance is due to an increase of the light-harvesting: the energy absorbed by the luminophore is transferred to the perovskite, and to a resonance effect between the Frenkel exciton of the luminophore and the Wannier exciton of the perovskite.

Functionalizing the organic part of hybrid perovskites with adequate dyes in order to increase light harvesting can be a promising path to enhance PSCs performance.



**Figure 1:** 2-dimensional layered structure of  $(\text{RNH}_3)_2\text{MX}_4$  hybrid perovskites.



**Figure 2:** Spin-coated layers illuminated under 360nm UV-lamp. (a) Standard lead bromide 2D-perovskite layer  $(\text{C}_6\text{H}_5\text{-C}_2\text{H}_4\text{-NH}_3)_2\text{PbBr}_4$  (b) organic luminophore (NAAB) polycrystalline layer and (c) luminophore-functionalized perovskite layer.

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2. Zhang, S.; Lanty, G.; Lauret, J.-S.; Deleporte, E.; Audebert, P.; Galmiche, L. *Acta Mater.* **2009**, *57*, 3301–3309.
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