

Fast growth of monocrystalline thin films of 2D layered hybrid perovskite

Ferdinand Lédée^{1,2}, Gaëlle Trippé-Allard¹, Hiba Diab¹, Pierre Audebert², Damien Garrot³, Jean-Sébastien Lauret¹, Emmanuelle Deleporte¹

¹ Laboratoire Aimé Cotton, CNRS, Université Paris-Sud, ENS Paris-Saclay, Université Paris-Saclay, France

² PPSM, ENS Paris-Saclay, CNRS, Université Paris-Saclay, France

³ GEMaC, CNRS, Université Versailles-Saint-Quentin, Université Paris-Saclay, France

Email : ferdinand.ledée@ens-cachan.fr

Abstract :

During the past few years hybrid organic-inorganic perovskites (HOIPs) have attracted much interest as solution-processed semiconductors with high potentialities in optoelectronics and photovoltaics. On the one hand 3D HOIPs such as $\text{CH}_3\text{NH}_3\text{PbI}_3$ have shown their outstanding performances when incorporated in solar cells [1]. On the other hand their 2D layered counterparts such as $(\text{C}_6\text{H}_5\text{C}_2\text{H}_4\text{NH}_3)_2\text{PbI}_4$ (PEPI) are promising materials for light emitting devices because of their strong emission at room temperature [2]. However, the optoelectronic properties of hybrid perovskite polycrystalline films suffer from a microscale grain structure. In order to take advantage of the great potential of these materials for both photovoltaics and emitting devices, the synthesis of large monocrystalline films is a key issue. Here we propose a fast crystallization method for the 2D layered hybrid perovskite PEPI. A vapor-assisted process coupled with a capping of the precursor solution allows to grow 2-dimensionnal thin films with millimetric monocrystalline grains, a high aspect ratio and a good surface quality (Fig.1). Moreover, this growth is several orders of magnitudes faster than the other reported techniques. In addition, we highlight the benefits of using γ -butyrolactone (GBL) for the growth of layered perovskites monocrystalline grains.

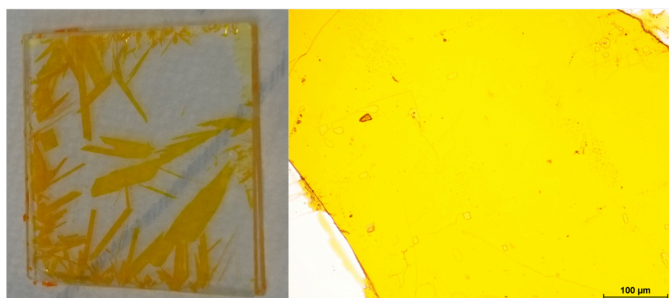


Figure 1. Optical images of 2-dimensionnal PEPI crystals (size of the quartz plate is 25x25 mm).

- [1] “efficiency_chart NREL.” [Online]. Available: http://www.nrel.gov/ncpv/images/efficiency_chart.jpg. [Accessed: 20-May-2016].
- [2] K. Gauthron, J.-S. Lauret, L. Doyennette, G. Lanty, A. Al Choueiry, S. J. Zhang, L. Largeau, O. Manguin, J. Bloch, and E. Deleporte, “Optical spectroscopy of two-dimensional layered $(\text{C}_6\text{H}_5\text{C}_2\text{H}_4\text{-NH}_3)_2\text{-PbI}_4$ perovskite”, *Opt. Express*, vol. 18, no. 6, pp. 5912–5919, 2010.

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