

Fast growth of monocrystalline thin films of 2D layered hybrid perovskites [1]

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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 [2]. 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 [3]. However, the optoelectronic properties of hybrid perovskite polycrystalline films suffer from a microscale grain structure [4]. 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 layered hybrid perovskites. 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. In addition, we highlight the benefits of using γ -butyrolactone (GBL) for the growth of layered perovskites monocrystalline grains.

- [1] [F. Lédée, G. Trippé-Allard, H. Diab, P. Audebert, D. Garrot, J.-S. Lauret, and E. Deleporte, "Fast growth of monocrystalline thin films of 2D layered hybrid perovskite," *CrytEngComm*, vol. 8, pp. 208–215, 2017.](#)
- [2] "efficiency_chart NREL." [Online]. Available: http://www.nrel.gov/ncpv/images/efficiency_chart.jpg. [Accessed: 20-May-2016].
- [3] K. Gauthron, J. Lauret, L. Doyennette, G. Lanty, A. Al Choueiry, S. J. Zhang, L. Largeau, O. Mauguin, 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.
- [4] W. Nie, H. Tsai, R. Asadpour, A. J. Neukirch, J.-C. Blancon, G. Gupta, J. J. Crochet, M. Chhowalla, S. Tretiak, M. a Alam, H. Wang, and A. D. Mohite, "High-efficiency solution-processed perovskite solar cells with millimeter-scale grains," *Science (80-.)*, vol. 347, no. 6221, pp. 522–525, 2015.

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