

Asymmetrical Single Crystals Containing Tilted Ruddlesden – Popper Phases for Efficient Perovskite Solar Cells

Hao-Yeu Tsai, Yung-Fang Yang, Hong-Sheng Jiang, Fang-Chung Chen*

¹Department of Photonics, National Yang Ming Chiao Tung University, Hsinchu, 30010, Taiwan

²Center for Emergent Functional Matter Science, National Yang Ming Chiao Tung University, Hsinchu, 30010, Taiwan

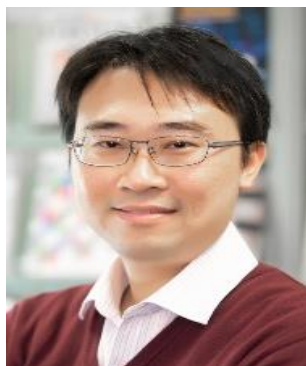
*Corresponding author: E-mail: fcchendop@nycu.edu.tw

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Abstract

Two-dimensional (2D) perovskites are attracting greater amounts of attention because of their superior device stability. The framework is “cut” into corner-sharing PbX_6 layers, known as Ruddlesden – Popper (RP) phases, by the bulky A-site cations. For most of the cases, the insulating moieties of the cations significantly affect charge transport in the 2D perovskites, thereby limiting the power conversion efficiencies (PCEs) of perovskite solar cells (PeSCs). In this talk, we propose a new space-limited crystallization method for growing asymmetric 2D perovskite single crystals (SCs); in particular, the RP phases are nearly vertically oriented respect to the substrates. Such unique preferred orientation of the layered structures minimize the impact of the bulky side chains of the bulky cations. From the results of grazing incidence small angle X-ray scattering, we also find that the RP phases are aligned with a tilt angle of close to 22° respect to the substrate. We suspect that the strong p-p interaction between the benzene rings of the ammonium cations and the surface of the hole transport layer play important roles in determining the unique crystalline structure. A PCE of greater than 16% is obtained after surface passivation.

Biography of Presenting Author



Fang-Chung Chen is current a Professor and Chairman of Department of Photonics (DoP), National Yang Ming Chiao Tung University (NYCU). He received the B.S. and master degree in Chemistry from National Taiwan University, Taiwan, in 1996 and 1998, respectively, and the Ph.D. degree in Materials Science and Engineering from University of California, Los Angeles (UCLA), USA, in 2003. He was a postdoctoral research associate in Department of Materials Science and Engineering, UCLA in 2003. He joined DoP, National Chiao Tung University (NCTU, now NYCU) since Feb. 2004. He was also the chairman of Degree Program of Flat Panel Display Technology, NCTU. He has published more than 130 Journals papers, 100 conference papers, 5 book chapters, and owned 14 patents. Prof. Chen is a Fellow of the Royal Society of Chemistry (FRSC). He is also the recipient of 2021 IoT Innovation Award (Pen Wen Yuan Foundation), 2020 Y. Z. Hsu Scientific Paper Award and Award for Junior Research Investigators of Academia Sinica 2008, which is one of the most important awards for junior research

investigators in all research fields in Taiwan. He is the section editor (Organic Materials) of Encyclopedia of Modern Optics, edition II, Elsevier and a member of Editorial Board for Processes (MDPI) and Current Smart Materials. His h-index is 48 (Google Scholar). His research interests include flexible solar cells, organic electronics and materials, perovskite electronics, plasmonic materials and low-dimensional nanomaterials.

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