

Crystal Orientation Manipulated by Electric Field for High-Quality Perovskite Film

Congcong Zhang¹, Hiroyuki Okada¹, and Zhaokui Wang²

Univ. of Toyama,¹ Soochow Univ.²

E-mail: zhangcngcng@126.com

Organic/inorganic hybrid perovskite materials have attracted much attention due to its excellent characteristics. However, there are many issues yet to be addressed. An important issue is the uncontrolled crystallization of the perovskite absorber layer prepared by one step spin-coating process. Crystallinity directly affects carrier generation, separation and transport and the energy band of the absorber layer. Therefore, regardless of the chemical composition, the crystallinity of absorber layer plays a dominant role in a photovoltaic device. There are many methods have been used^[1,2].

Combining with our previous result, in this work, a vertical EEF perpendicular to the substrate are respectively applied to MAPbI_{3-x}Cl_x, MAPbI₃ and Cs_{0.05}(FA_{0.83}MA_{0.17})_{0.95}Pb(I_{0.83}Br_{0.17})₃ perovskite films, according to XRD and GIXRD result analysis, perovskite crystals can be changed obviously. Typically, it effectively stretches perovskite crystals along its direction while simultaneously shrinking them in a perpendicular direction, regardless of the direction of EEF (i.e. either upward or downward). Remarkably, this lattice extension effect of EEF is universal in perovskite systems with different A-site components. In addition, detail characteristics for morphologies, polarization and photovoltaic properties are also included. It reveals the mechanism of EEF induced preferred crystallization in perovskite solar cell.

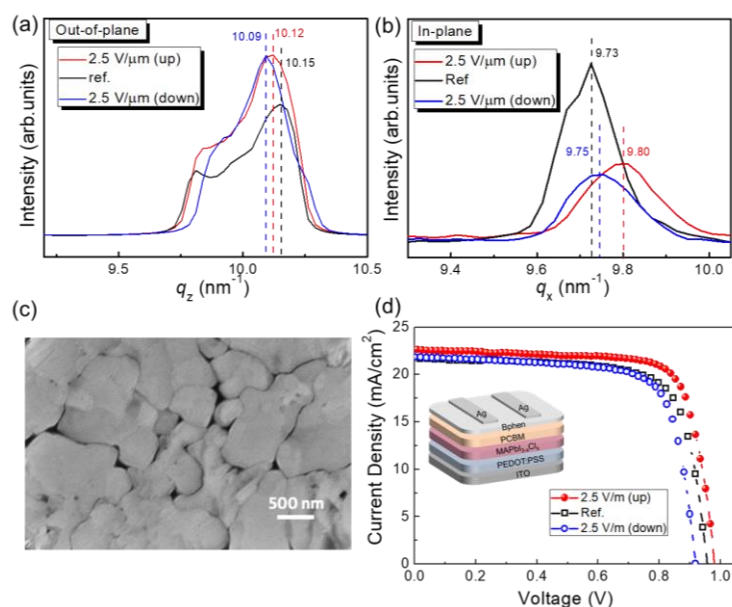


Figure 1. GIXRD plots along (110) plane of MAPbI_{3-x}Cl_x perovskite in (a) out-of-plane and (b) in-plane directions. (c) SEM of MAPbI_{3-x}Cl_x perovskite film under 2.5 V/μm up-EEF. (d) *J-V* curves.

- 1) Congcong Zhang *et al.* *J. Mater. Chem. A*, 2018, 6, 1161–1170
- 2) Jiang Liu *et al.* *ACS Appl. Mater. Inter.* 2015, 7, 24008–24015.