

#ICMolTalks

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📍 Assembly Hall - ICMol

**Abstract*****Enabling Technology of Atomic Layer Deposition for Perovskite Solar Cells with Light Absorbing Layer of Formamidinium Lead Tri-iodide (FAPbI₃)***

Formamidinium Lead Tri-Iodide (FAPbI₃) is a semiconductor with an optimal band gap of ~ 1.5 eV now serving as a pivotal absorber in high-performance optoelectronic devices, notable example is the Perovskite solar cell. Although α -FAPbI₃ is the most thermodynamically stable photoactive phase, it can kinetically stabilize δ -FAPbI₃ in ambient. Many attempts were studied to stabilize the black α -phase, for example, pseudo-halide anion engineering, ionic liquid engineering, and incorporation of additives. The organic-inorganic metal halides with the crystal structure of perovskite, characterized by a soft lattice system, demonstrates notable changes in its physical properties when subjected to external optical, electrical, and mechanical stimuli. In this study, FAPbI₃ thin films with the preferred oriented (001) grains were synthesized by adding MAI upto 40 % to the precursor solution and subsequently spun up and annealing. We have measured the mobility decay curves utilizing both in-plane and out-of-plane time-resolved microwave conductivity (TRMC) measurements. Furthermore, we have observed circular polarization-dependent carrier dynamics within a timescale of 1 ps through pump-probe transient absorption spectroscopy with an optical microscope. Distinct carrier populations were discerned for right- and left-handed polarization probe beams, indicating the presence of circular dichroism in the films of FAPbI₃. This phenomenon is attributed to the Rashba band splitting, which arises from light-induced centro-symmetry breaking in the (001)-preferred orientation FAPbI₃ thin films. Rashba band splitting, as demonstrated by the observation of ultrafast spin domain formation, indicates a momentum mismatch in excited electrons and holes, thereby resulting in a long carrier lifetime. As a result, (001)-preferred orientation FAPbI₃ perovskite solar cells exhibited a power conversion efficiency of approximately 24 %.