

## Optimization of suitable chloride precursor for better crystal growth of MAPbI<sub>3</sub>

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Perovskite based solar cells studies are highly important due to its rapid increase in efficiency up to 20.1%. Therefore more attention is needed for realizing the highly efficient perovskite solar cell. Although the efficiency of the solar cells depends on the various parameters like perovskite materials, thickness, HTL materials, and so on, highly efficient perovskite solar cells basically requires controlled crystal growth and more surface area coverage. Here we report the improvement in CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> crystals by adding different chloride based additives.

In CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite addition of Cl is very crucial since it decides the crystal size of the perovskite. However, the optimized precursor and quantity is still unrevealed in perovskite research. In our work we found the impact of alkyl chain length in different chloride precursors on the crystal growth of lead-halide perovskite as shown in Fig.1. We successfully optimized the crystal growth of CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> perovskite in one step method by adding CH<sub>3</sub>CH<sub>2</sub>NH<sub>3</sub>Cl (EACl) in smaller ratio at maximum of 12 wt% concentration. The addition of EACl increases the crystal size almost two times as compared to the standard perovskite crystals. They have preferential orientation along (110) plane and the quality of crystals were improved highly.

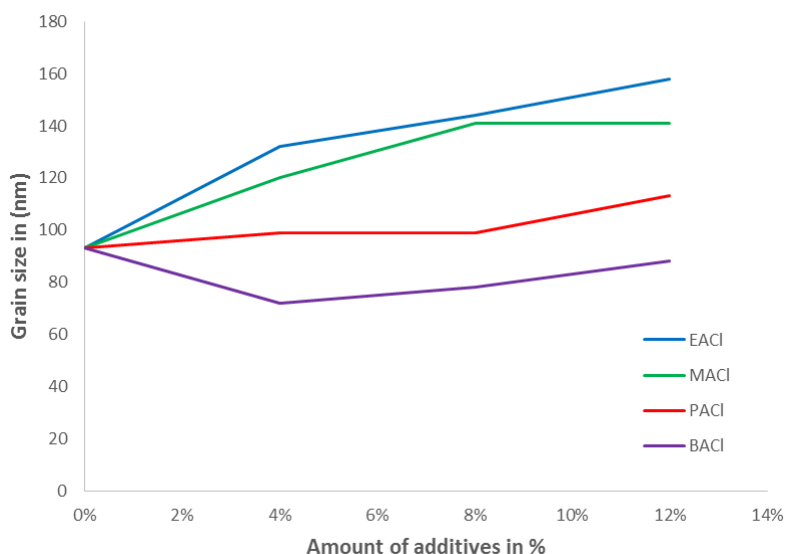


Fig. 1. Relationship between alkyl chain length of organic amines and grain size