Real-Time Insights into Perovskite Evolution: In Situ GIWAXS and Optoelectronic Studies of PEACI-PPF Co-Passivated Cs0.1FA0.9Pb13 Thin Film Growth <u>Miller Shatsala^{1,2}</u> Celine Awino² Maxwell Mageto² Husein Golicha² Tamura Nobumichi¹ ¹Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA, USA ²Department of Physics, Masinde Muliro University of Science and Technology, Kakamega, Kenya

The mixed-cation perovskite $C_{50.1}FA_{0.9}PbI_3$, passivated with phenylethylammonium chloride (PEACl) and 2,8-Bis(diphenyl-phosphoryl)dibenzo[b,d]furan (PPF), demonstrates improved growth kinetics and optoelectronic performance. In situ GIWAXS, PL, and UV-Vis mapping show that co-passivation suppresses the δ -phase, promotes direct α -phase formation, and enhances film uniformity by reducing defects and improving grain orientation. PEACl-PPF synergy stabilizes precursor complexes, slows nucleation, and enables controlled crystallization. PPF's coordination with Pb²⁺ and halides minimizes δ -phase nucleation, supporting stable α -phase growth, offering insights for optimized perovskite films.

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1Li, Wang, et al. "Co-passivation of perovskite film towards stable and efficient perovskite solar cell." Chemical Engineering Journal 471 (2023): 144561.



Figure 1. A sequential growth the perovskite from solution to alpha phase