Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Use of Nanoconfinement to Control Metal-Halide Perovskite Crystallization and Stability SANGCHUL LEE, JOSHUA FELDMAN, STEPHANIE LEE, Department of Chemical Engineering and Materials Science, Stevens Institute of Technology — We present a systematic study of the effect of nanoconfinement on the crystallization of methylammonium lead halide ($MAPbI_3$) perovskite crystallization. $MAPbI_3$ was spin coated onto anodized aluminum oxide (AAO) templates with uniaxially-aligned pores ranging from 20 – 200 nm in diameter and examined using 2-D X-ray diffraction and scanning electron microscopy. X-ray diffraction patterns revealed the presence of a transient precursor phase that converts to the $MAPbI_3$ crystal structure upon thermal annealing. The orientation of the precursor phase and conversion rate to the $MAPbI_3$ crystal structure were found to depend on the pore size of the AAO template. The stability of $MAPbI_3$ in air also depends on the extent of nanoconfinement. When deposited on flat SiO_2 surfaces, $MAPbI_3$ degraded into PbI_2 and MA after 21 days. When deposited in AAO templates exhibiting 20-nm pore sizes, however, $MAPbI_3$ crystals were stable for longer than 16 days. These findings suggest that nanoconfinement of $MAPbI_3$ crystals may be a promising strategy for improving the stability of perovskite-based solar cells.

Sangchul Lee
Department of Chemical Engineering and Materials Science, Stevens Institute of Technology

Date submitted: 04 Nov 2015 Electronic form version 1.4