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Nanoscale Characterization of Organometal Trihalide Perovskite using Photothermal Induced Resonance (PTIR) Technique JUNGSEOK CHAE, ANDREA CENTRONE, Center for Nanoscale Science and Technology, National Institute of Standards and Technology, YONGBO YUAN, YUCHUAN SHAO, QI WANG, ZHENGGUO XIAO, QINGFENG DONG, JINSONG HUANG, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln — Further improvement of the performance of organometal trihalide perovskites (OTP) solar cells can be aided by nanoscale characterization. Photothermal induced resonance (PTIR), is a novel scanning probe method that enable measuring vibrational and electronic absorption maps and spectra with a resolution as high as 20 nm. In this presentation, the chemical composition and bandgap of OTP thin films was characterized with PTIR: 1) to identify the origin of the switchable photovoltaic effect and 2) to quantify the local chloride content in mixed-halide perovskites. PTIR vibrational maps recorded in correspondence of methyl ammonium ions (MA+) for a as prepared lateral structure solar cell were uniform but displayed stronger intensity in proximity of the cathode after electric poling. Those measurements provide the first direct proof of ion electron migration in OTP devices. Because chloride incorporation modifies the bandgap in MAPbI3-xClx perovskites, PTIR electronic maps and spectra were used to extract the local chloride content as a function of annealing. Results show that the as-prepared sample consist of a mixture of Cl-rich and Cl-poor phases that evolves into a homogenous Cl-poorer phase upon annealing. This measurement suggests that Cl- is progressively expelled from the film.

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