Characterization of organic-inorganic perovskites $MAPbX_3$ by X-ray absorption spectroscopy

Hong-Wei Kuo (郭鴻偉)[1], Yu-Chen Huang (黃裕呈)[1, 2], Ying-Rui Lu (盧英睿)[1], Chung-Li Dong (董崇禮)[2], Chen, Chi-Liang (陳啓亮)[1*]

[1.] National Synchrotron Radiation Research Center, Hsinchu, 30076, Taiwan
[2.] Department of Physics, Tamkang University, New Taipei, 25137, Taiwan.

Methylammonium lead halide perovskite-based (MAPbX3, where MA is methyl ammonium $CH_3NH_3^+$, and X is a halide Br^-, and I^-) solar cells (HPSCs) have become a prominent field of research focus in the current solar cell exploration field due to the high absorptivity, tunable band structure and energy gap, advantage of simple preparation, low cost and high efficiency. Organic-inorganic layered perovskites with a demonstrated solar power conversion efficiency (PCE) exceeding over 20% have been extensively investigated and are cheaper to manufacture than silicon. More significant material scientific investigations in these novel layered geometry photovoltaics materials need to be conducted to further tune the band gap, upgrade the transport properties, to observe the charge carrier dynamics, and rise the chemical stability. Recently, we have successfully synthesized related precursor and halide perovskite-based samples. Our investigations with the incorporation of different ratios of halides (anion) in perovskites revealed significant spectral changes in the XAS spectra. A distorted octahedral symmetry in perovskite structure is observed. The stability of these halide perovskite-based materials is strongly correlated to the lattice structure. The electronic charge transition mechanisms of photoelectron near the Fermi level (EF) before and after the visible light irradiation were also studied by in situ x-ray absorption spectroscopy. .