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***In situ/operando* soft x-ray spectroscopy characterization of ion solvation and catalysis.** YI-SHENG LIU, JINGHUA GUO, Lawrence Berkeley Natl Lab — Many important systems especially in energy-related regime are based on the complexity of material architecture, chemistry and interactions among constituents within. To understand and thus ultimately control the varying applications calls for in-situ/operando characterization tools. We will present the recent development of the in-situ/operando soft X-ray spectroscopic in the studies of catalytic and alkali ion solvation under bias condition, and reveal how to overcome the challenge that soft X-rays cannot easily peek into the high-pressure catalytic cells or liquid electrochemical cells. Also the different feasible detection approaches can provide surface and bulk sensitivity experimentally from those *in-situ* cells. The unique design of *in-situ/operando* soft X-ray spectroscopy instrumentation and fabrication principle with examples in Ca, Na, Mg based solutions at ambient pressure/temperature and high temperature (˜250C) gas catalysis will be shown.

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