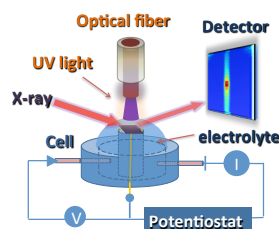
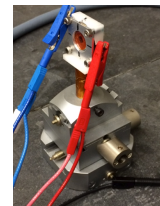




Operando Methods for The Study of Energy Materials

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This presentation will deal with the development of *operando* methods for the study and characterization of fuel cell and battery materials. The presentation will begin with a brief overview of the methods employed. Particular emphasis will be placed on the use of X-ray diffraction (XRD), X-ray absorption spectroscopy (XAS) X-ray microscopy and tomography and transmission electron microscopy (TEM) under active potential control. The utility of these methods will be illustrated by selected examples including electrocatalysts for the oxygen reduction reaction and spectroscopic studies of Li/S batteries. The use of operando TEM will be illustrated by studies of fuel cell catalyst degradation and coalescence and lithiation/de-lithiation dynamics of LiFePO_4 via energy-filtered TEM. Finally the concept of symmetrical redox flow batteries will be demonstrated. The presentation will conclude with an assessment of future directions.

