Adventures in Ultrafast Spectroscopy:
Electron Transfer in Dye-Sensitized Metal Oxides

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Motivation. Develop a better understanding of charge transport in dye-sensitized metal oxides on an ultrafast timescale.

Specific Goal. Study the mechanism of electron transfer and trapping using time-resolved THz spectroelectrochemistry. Leverage time-resolved X-ray absorption to probe the change in electronic structure after electron transfer with element specificity.

Time-Resolved THz Spectroelectrochemistry (TRTSEC)

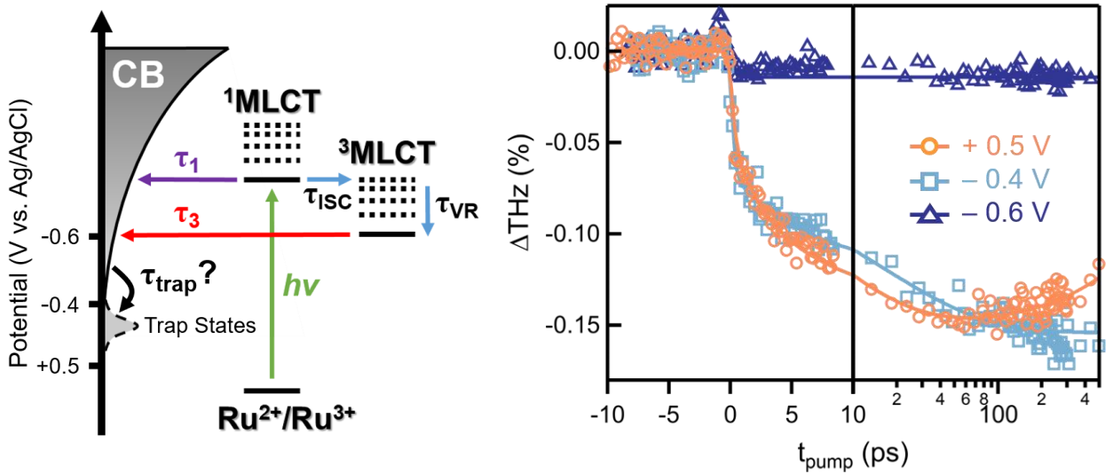

Figure 1. (left) Schematic of electron transfer and photophysical processes in **RuP**-sensitized anatase TiO_2. **RuP** is phosphonated $Ru(bpy)_3$. (right) TRTSEC measurement at various potentials showing suppression of trapping and injection from the ^{3}MLCT excited state.

Picosecond Time-Resolved X-Ray Absorption Spectroscopy (TR-XAS)

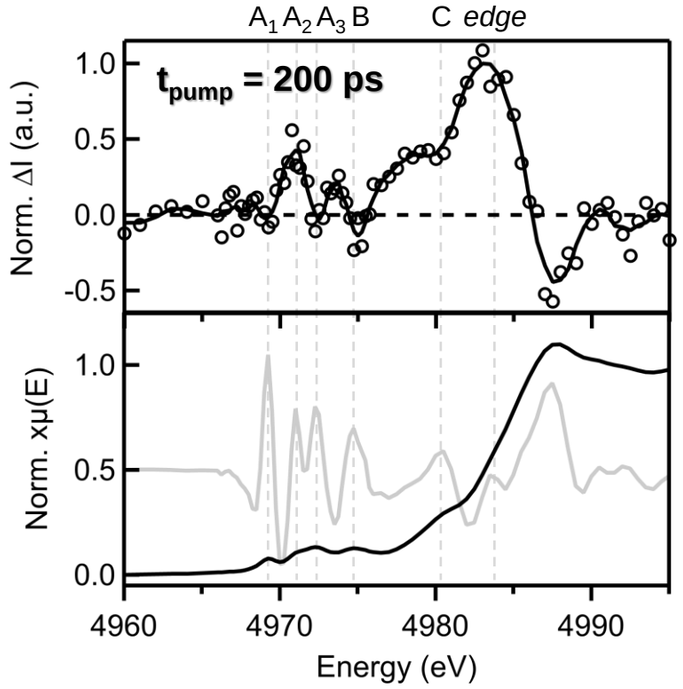

Figure 2. (top) TR-XAS spectrum and (bottom) dark XAS spectrum at the Ti K-edge showing an edge shift and enhancement of delocalized pre-edge features.

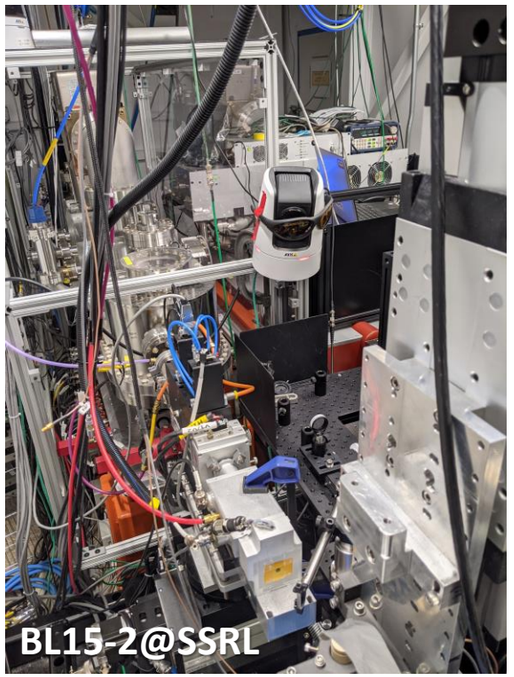

Figure 3. TR-XAS beamline at the Stanford Synchrotron Radiation Lightsource.

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