

Transition Metal Photochemistry Revealed by Femtosecond M-edge XANES

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Catalyst development and optimization requires detailed understanding of transition states and reactive intermediates. We have developed M_{2,3}-edge XANES as an ultrafast probe of the electronic structure of transition metal complexes: the shape and position of the 3p→3d transition is specific to the element, oxidation state, spin state, and ligand-field. This poster will detail our work over the past year in applying this technique to more complex transition metal complexes. We used the element specificity to probe the excited state of Co dithiolene complex with redox non-innocent ligands and revealed an interplay between metal-centered and charge-transfer excited states. To measure short-lived states in [NiFe] hydrogenase mimics, we synthesized a chromophore-catalyst dimer and showed that the metal centers can be readily photo-oxidized with high quantum yield. Finally, we have implemented an in-vacuum liquid sheet that is stable for hours and enables solution-phase XUV spectroscopy.