DEVELOPMENT OF SOLUTION-PHASE XUV ABSORPTION SPECTROSCOPY

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Ultrafast extreme ultraviolet (XUV) absorption spectroscopy can be used to probe the dynamics of excited states in first-row transition metals complexes with sensitivity to the oxidation state, spin state, and ligand field of the metal center. This technique can be performed with a tabletop instrument and probes the M-edge transitions from the 3p to the 3d orbital of a metal center. This technique is analogous to K-, and L-edge spectroscopy, which are performed at synchrotron or x-ray free electron lasers. These user-based facilities offer high photon counts and ultrafast time resolution, however beamtime is limited. Fortunately, the use of tabletop sources to generate XUV light with femtosecond time resolution has become a more widely available source of x-ray spectroscopy. XUV absorption spectroscopy has until now been limited to studying solid-state or gas-phase samples due to short penetration depth of XUV photons. To study solutions with XUV absorption, I used a microfluidic chip to generate free flowing liquid sheets of nonpolar, XUV transmissive solutions. I have characterized the thickness and stability of chloroform liquid sheets under vacuum and have adapted our tabletop high-harmonic instrument to maintain high vacuum. This sample delivery method now makes ultrafast XUV absorption spectroscopy available to study an array of transition-metal complexes in the solution phase.