EXTENDING TABLETOP XUV SPECTROSCOPY TO THE LIQUID PHASE TO EXAMINE TRANSITION METAL CATALYSTS

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M-edge spectroscopy of first row transition metals (3p to 3d excitation) is the low energy analogue of more well-known K- and L-edge spectroscopy, but can be implemented without the use of a synchrotron. Instead, M-edge spectroscopy can be performed as a tabletop method, relying on high harmonic generation (HHG) to produce ultrashort ($\sim$ 20 fs) pulses of extreme ultraviolet (XUV) light in the range of 10-100s of eV. We have shown tabletop M-edge spectroscopy to be a valuable tool in determining the electronic structure of metal-centered coordination complexes and have demonstrated its capacity to yield element-specific information about a compound's oxidation state, spin state, and ligand field. The power of this technique to distinguish these features makes it a promising addition to the arsenal of methods used to study metal-centered catalysts. A catalytic reaction can be initiated photochemically and the XUV probe can be used to track oxidative and structural changes to identify the key intermediates. Until recently tabletop XUV spectroscopy has been performed on thin film samples, but in order to examine homogeneous catalysis, the technique must be adapted to look at samples in the liquid phase. The challenges of adapting tabletop XUV spectroscopy to the liquid phase lie in the lower attenuation length of XUV light compared to soft and hard x-rays and the lower flux compared to synchrotron methods. As a result, the sample must be limited to a sub-micron thickness as well as isolated from the vacuum environment required for x-ray spectroscopy. I am developing a liquid flow cell that relies on confining the sample between two x-ray transmissive SiN membranes, as has been demonstrated for use at synchrotrons, but adapted to the unique difficulties encountered in tabletop XUV spectroscopy.