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Probing High Temperature and Pressure Reactions and Gas States with VUV and X-rays

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Synchrotron light sources offer many opportunities for probing chemical and physical properties. For example, VUV-photoionization mass spectrometry gives detailed insights into the reactions of transient species of importance to atmospheric chemistry and combustion. At much higher photon energies ex-situ and in-situ, X-ray scattering experiments examine particle formation within flames. In recent years, there have been significant advances in the reactors used to perform gas phase experiments at light sources and the diagnostics to probe them. These developments have resulted in gas phase chemical kinetic experiments at simultaneous high temperatures and pressures and in-situ methods of probing conditions in new and traditional reactors such as shock tubes, flow tubes and flames.

X-ray densitometry (Advanced Photon Source, Argonne National Laboratory), to determine post shock gas states, and VUV-PIMS (Advanced Light Source, Lawrence Berkeley National Laboratory), to study chemical reactions, experiments with a miniature shock tube will be presented. Some of the remaining challenges to recovering kinetic as well as mechanistic data from the shock tube experiments will be briefly discussed. X-ray fluorescence and absorption (APS) to determine temperature and density fields in flames and micro-reactors will also be discussed.

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