Small Angle X-ray Studies of Particle in Flames

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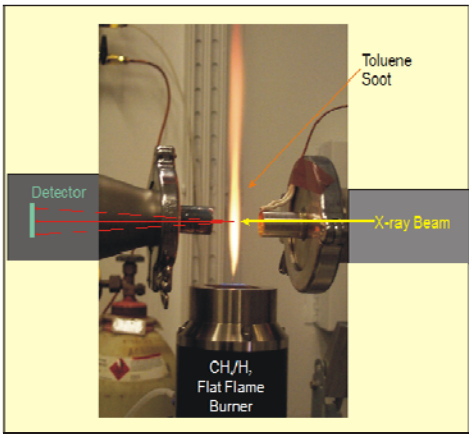
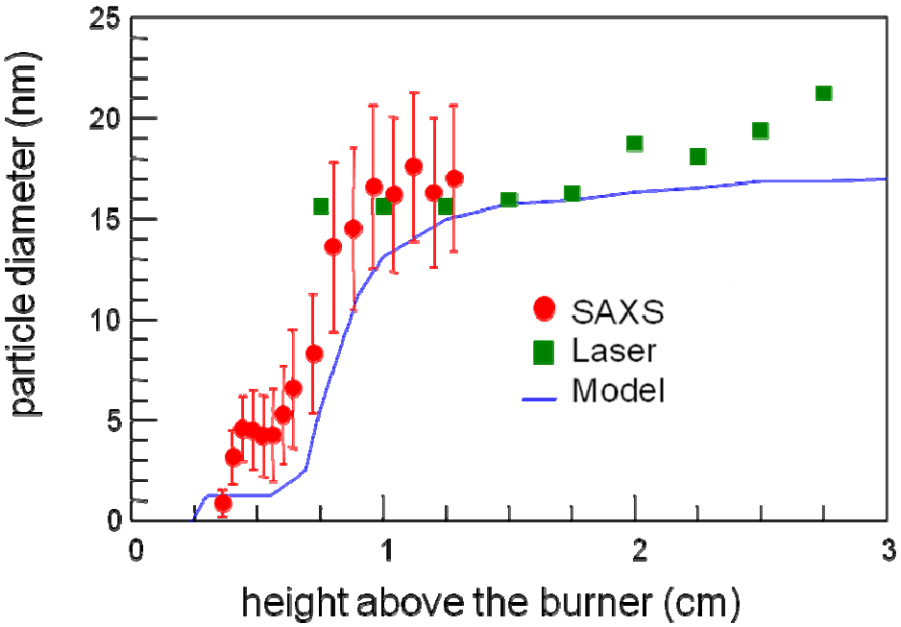
The initial stages of soot formation have been probed using small angle scattering with X-rays produced on an undulator beamline (ID-12) at the Advanced Photon Source. An important stage of soot formation in the combustion process, which lacks a detailed mechanistic understanding, is the synthesis of the presoot molecules. Small angle X-ray scattering has been used to study soot formation in fuel rich flames in the size range of larger molecules to small particles providing size, shape, and density information. From *in situ* SAXS we reported observing molecules with radii as small as 8 A, however, refining the experiment and the analysis procedure has produced data which suggest that molecules as small as naphthalene can be observed. In addition, we have shown that scattering from naphthalene can be observed in the gas phase by SAXS. Also, by taking a large number of data sets across the flame and applying an Abel transformation, the distribution of particles in the flame can be determined. More recently we have begun to study the formation of nano-catalysts which ar being used for catalytic combustion in ram jets.



SAXS Flame Setup



Change in Soot Particle Size with Time (height above the burner)