**115f Dynamics of Particle Formation and Growth in Spray Flame Pyrolysis Using in Situ X-Ray Scattering**

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Spray flames offer a versatile method of nano-particle formation where the precursor species are liquids which are pumped through a spray nozzle producing a high flow-rate aerosol that is rapidly pyrolyzed by support flamlets and/or by combustion of the solution. Aerosol streams are typically narrow, on the order of 1 mm, and proceed at speeds approaching sonic velocities due to the pumping speed combined with an extremely steep temperature gradient. Typically, spray flames operate at much higher temperatures compared to vapor flames. In situ light scattering measurements are extremely difficult for spray flames due to high optical emission that can necessitate the use of shaded goggles for operators. Other particle analysis techniques such as differential mobility analysis are difficult to apply due to the high flow rates and high particle concentrations. Using synchrotron x-rays we have studied spray flames of solvent and solvent/inorganic precursor with 50 micron spatial resolution over 100's of millimeters spatial extent and with exposure times of 20 ms. Particle/droplet size, polydispersity, number density, mass-fractal dimension, branch content and degree of aggregation (number of primary particles per aggregate) have been routinely determined. This data combined with velocity measurements (using a phase doppler anemometer(PDA)) lead to droplet evaporation rates, particle nucleation rates, growth rates and aggregation rates. In addition to this quantification of the dynamics of particle formation, the 2D SAXS (small angle x-ray scattering) technique allows for observation of droplet and aggregate asymmetry in these extremely high shear-rate flows.