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Preliminary Experimental Results using a Steady State ICP Flow Reactor to Investigate Condensation Chemistry for Nuclear Forensics¹ BATIKAN KOROGLU, MIKE ARMSTRONG, Lawrence Livermore National CAPPELLI, Stanford University, ALEX Laboratory, MARK CHERNOV, JONATHAN CROWHURST, MARCO MEHL, HARRY RADOUSKY, TIMO-THY ROSE, JOE ZAUG, Lawrence Livermore National Laboratory — The high temperature chemistry of rapidly condensing matter is under investigation using a steady state inductively coupled plasma (ICP) flow reactor. The objective is to study chemical processes on cooling time scales similar to that of a low yield nuclear fireball. The reactor has a nested set of gas flow rings that provide flexibility in the control of hydrodynamic conditions and mixing of chemical components. Initial tests were run using two different aqueous solutions (ferric nitrate and uranyl nitrate). Chemical reactants passing through the plasma torch undergo non-linear cooling from $\sim 10,000$ K to 1,000 K on time scales of < 0.1 to 0.5s depending on flow conditions. Optical spectroscopy measurements were taken at different positions along the flow axis to observe the in situ spatial and temporal evolution of chemical species at different temperatures. The current data offer insights into the changes in oxide chemistry as a function of oxygen fugacity. The time resolved measurements will also serve as a validation target for the development of kinetic models that will be used to describe chemical fractionation during nuclear fireball condensation.

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