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Time-dependent small-angle X-ray and neutron scattering studies of solution-mediated nanoparticulate nucleation, growth and alignment. ANDREW J. ALLEN, VINCENT A. HACKLEY, NIST Ceramics Division, Gaithersburg, MD — A remote-controlled, isothermal, circulating fluid flow cell has been developed for small-angle X-ray and neutron scattering (SAXS and SANS) studies of suspensions with online monitoring of flow rate, temperature or conditions, e.g., pH. Used with the small X-ray beams available at 3rd generation synchrotron sources and the nanometer-to-micrometer scale range accessible in ultrasmall-angle X-ray scattering studies, structural characteristics ranging from 1 nm to several micrometers can be measured, in situ and in real time, as a function of changing physical or chemical conditions. Used with time-resolved pinhole SAXS instruments, rapid reaction precursor phenomena at the nanoscale level can be similarly studied. Used in SANS studies, a neutron-adapted version of the flow cell allows real-time contrast variation techniques to further elucidate the structural evolution. Applications will be discussed for real-time studies of solution-mediated nanocrystalline ceramic oxide formation, and Au nanowire alignment in extensional flow.

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