

Abstract Submitted
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Control of Mass Transport and Chemical Reaction Kinetics in Ultrasmall Volumes CHARLES COLLIER, ORNL — This talk will describe means for triggering chemical reactions for studying reaction kinetics under extreme confinement with sub-millisecond temporal resolution, including on-demand generation and fusion of femtoliter (10^{-15} L) volume water-in-oil droplets, and triggering reactions in femtoliter chambers microfabricated in poly(dimethylsiloxane) (PDMS). We demonstrated a reversible chemical toggle switch, which lays the groundwork for exploring more complex chemical and biochemical reaction sequences triggered and monitored in real time in discrete ultrasmall reactors, such as sequential and coupled enzymatic reactions. We are also developing methods to vary confinement and macromolecular crowding in ultrasmall, water-in-oil droplets and chambers micromolded in PDMS as biomimetic reaction vessels containing minimal synthetic gene circuits, in order to better understand how confinement, reduced dimensionality and macromolecular crowding affect molecular mechanisms involved in the operation and regulation of genetic circuits in living cells.

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