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Controlled Gelation of Particle Suspensions Using Controlled Solvent Removal in Picoliter Droplets SHARON VUONG, LYNN WALKER, Department of Chemical Engineering, Carnegie Mellon University, SHELLEY ANNA, Department of Chemical Engineering and Department of Mechanical Engineering, Carnegie Mellon University — Droplets in microfluidic devices have proven useful as uniform picoliter reactors for nanoparticle synthesis and as components in tunable emulsions. However, there can be significant transport between the component phases depending on solubility and other factors. In the present talk, we show that water droplets trapped within a microfluidic device for tens of hours slowly dehydrate, concentrating the contents encapsulated within. We use this slow dehydration along with control of the initial droplet composition to monitor gelation of aqueous suspensions of spherical silica particles (Ludox) and disk-shaped clay particles (Laponite). Droplets are generated in a microfluidic device containing small wells that trap the droplets. We monitor the concentration process through size and shape changes of these droplets as a function of time in tens of droplets and use the large number of individual reactors to generate statistics regarding the gelation process. We also examine changes in suspension viscosity through fluorescent particle tracking as a function of dehydration rate, initial suspension concentration and initial droplet volume, and added salt, and compare the results with the Krieger-Dougherty model in which viscosity increases dramatically with particle volume fraction.

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