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Thermal processing routes to structure control in phase separating colloidal gels TUAN NGUYEN, YONGXIANG GAO, JUNTAE KIM, MATTHEW HELGESON, Univ of California - Santa Barbara — Sophisticated thermal quenching and annealing strategies to create bicontinuous or hierarchical morphology have allowed for the creation of molecular materials (metals, ceramics, minerals and polymers) with significantly enhanced properties. Here, we explore new routes by which similar thermal processing strategies can be applied to colloidal gels. Specifically, colloid-polymer mixtures with thermoresponsive bridging attractions are employed to characterize how the thermal path taken through regions of non-equilibrium phase separation and gelation determine the dynamics and arrest of colloidal gelation. Interestingly, we find that the dominant mechanism of gelation (percolation, arrested phase separation or attractive glass formation) is highly sensitive to both the colloid volume fraction as well as the non-equilibrium thermodynamic path to the gelled state. Using recently-developed Fourier correlation microscopy methods, we show that this sensitivity is due to the temperature dependence of competing time scales for diffusion, aggregation and phase separation. Ultimately, we show how the control of these dynamics by thermal processing can be used to tailor the microstructure and rheology of colloidal gels.

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