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Scaling of Phase-Separated Polymer Viscoelastic Properties Under Confinement

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Sensitive visualization and conformational control of biopolymer interactions at super-molecular (tens to hundreds of nanometers) dimensions is important because it is at these scales that biopolymers undergo liquid-liquid phase separation. In particular, it remains unclear how protein-protein interactions regulate the formation of non-membranous organelles, with specific functions inside the cell and how nanoscale confinement may regulate the physical properties of these structures. We address these challenges by using Convex Lens-induced Confinement (CLiC) technology to gently load polymers and biopolymers into a nanofabricated array of pits. We have tested this approach using solutions of two water-soluble polymers, polyethylene glycol and dextran, as a model system. Our tools enable us to confine polymeric solutions in 10-100 nanometer scales and visualize the phase separation directly. Additionally, we are performing particle tracking microrheology to study the mesoscale properties of dextran liquid droplets in order to explore the relationship between droplet sizes and their viscoelastic properties.

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