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Nonequilibrium all-aqueous fiber formation NIKI ABBASI, JANINE K. NUNES, ZEHAO PAN, HOWARD A. STONE, Princeton University — We study in-flow equilibration process of aqueous two-phase system (ATPS) of poly(ethylene glycol) diacrylate (PEGDA) and dextran (DEX), and we utilize these nonequilibrium systems to generate structured microfibers. A jet of a PEGDA-rich phase is formed in a continuous DEX-rich phase, inside a microfluidic device. As the ATPS equilibrates, a variety of microstructures evolve. These evolving fluid structures can be used as liquid templates to tune the size or the internal and surface microstructures of PEGDA fibers upon photopolymerization of the jet. We study the dynamics of the equilibration process, and the transient evolution of the liquid microstructures, by tuning parameters such as the initial composition of the phases and flow rates. We anticipate that this nonequilibrium all-aqueous fiber formation system may have important biotechnological applications, specifically for generation of scaffolds of different microstructures. The all-aqueous nature of this system allows for generation of biocompatible materials, not requiring washing steps needed for fibers based on water-oil systems. Moreover, the ultra-low interfacial tension of the ATPS, which is three orders of magnitude lower than that of water-oil, allows for facile generation of microfibers.

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