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Stirring a Cahn-Hilliard fluid in moving microdroplets SAIF A. KHAN, S.H. SOPHIA LEE, PENGZHI WANG, SWEE KUN YAP, National University of Singapore — Biochemistry within living eukaryotic cells occurs in dynamic heterogeneous fluid environments containing macromolecules such as proteins, nucleic acids and sugars; most *in-vitro* biochemical studies in dilute aqueous solutions do not capture this chemical and morphological complexity. Here, as an *in-vitro* model for *in-vivo* cellular environments, we investigate the dynamics of a phase separating aqueous polymer mixture within small moving droplets. We dispense aqueous mixtures of poly(ethylene glycol) (PEG) and dextran as droplets carried by an immiscible fluorinated oil at a microfluidic T-junction, and use high-speed optical microscopic imaging to observe dynamic phase behavior. In the static case, for off-critical compositions, this mixture separates via a spinodal mechanism into two phases- a PEG-rich phase and a dextran-rich phase. For moving drops, the polymer mixture exhibits a near continuum of flow and composition-dependent phase morphologies, from the 'unmixed' static morphology to complex percolated morphologies resembling *in vivo* cellular environments. We compare our measurements to previous theoretical and numerical studies of binary fluid mixing based on advective Cahn-Hilliard formulations.

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