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Transport of particle-laden viscoelastic suspensions: tuning particle behavior with elasticity and geometry ALEXANDER BARBATI, Massachusetts Inst of Tech-MIT, AGATHE ROBISSON, ELIZABETH DUSSAN V., Schlumberger-Doll Research Center, GARETH MCKINLEY, Massachusetts Inst of Tech-MIT — The transport of particle-laden viscoelastic suspensions is routine in several industrial and natural systems. Many applications, such as hydraulic fracturing in the oilfield, require the successive (and occasionally simultaneous) flow and placement or rigid particles, commonly known as proppant. Hydraulically-generated fractures are routinely less than 6 particle diameters in width. We investigate the flow of viscoelastic particle-laden suspensions in microfabricated geometries mimicking hydraulically-generated fractures under a variety of dynamic conditions to illustrate the interaction between inertia, elasticity, and geometry on particle behavior during flow. We characterize the flow in these model geometries with a combination of streakline imaging, particle image velocimetry, and direct imaging of model proppant particles embedded in the flow. We accompany these small-scale measurements with macro-scale interrogation of fluid rheology by measuring material functions of the working fluid in under shear and extension. These material functions are used in concert with imposed flow conditions and imaging results to identify dominant transport mechanisms on the channel and particle scale, which indicate overall system behavior.

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