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Microfluidics with Gel Emulsions CRAIG PRIEST, ENKHTUUL SURENJAV, STEPHAN HERMINGHAUS, RALF SEEMANN, Max-Planck-Institute for Dynamics and Self-Organization — Microfluidic processing is usually achieved using single phase liquids. Instead, we use monodisperse emulsions to compartment liquids within microchannel geometries. At low continuous phase volume fractions, droplets self-organize to form well-defined arrangements, analogous to foam. While it is well-known that confined geometries can induce rearrangement of foam compartments at the millimeter-scale, similar dynamics are also expected for gel emulsions. We have studied online generation, organization and manipulation of gel emulsions using a variety of microchannel geometries. "Passive" reorganization, based on fixed channel geometries, can be supplemented by "active" manipulation by incorporating a ferrofluid phase. A ferromagnetic phase facilitates reorganization of liquid compartments on demand using an electromagnetic trigger. Moreover, coalescence between adjacent compartments within a gel emulsion can be induced using electrical potential. Microfluidics using gel emulsions will be well-suited for combinatorial chemistry, DNA sequencing, drug screening and protein crystallizations.

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