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Dynamics assembly of magnetic microparticles suspended in moving droplets under the influence of magnetic fields[1] HELMUT STREY, ERIC BROUZES, TRAVIS KRUSE, Stony Brook University — Droplet microfluidics has experienced tremendous growth, particularly since it is well suited for single-cell manipulation and analysis. As mature methods for high throughput droplet manipulation have been developed a technological bottleneck of current droplet microfluidics is that because droplets are separated, sequential chemical reactions are more difficult to achieve. For example, it is very difficult to concentrate target molecules, especially since every reaction step adds volume to the droplets. Our solution to this problem is to employ functionalized magnetic beads inside droplets. The basic idea is that an external magnetic field could be used to concentrate the magnetic beads in one part of the droplet and those could then be extracted by splitting the droplet. Here we present an experimental study of the self-assembly of superparamagnetic microparticles that are suspended in moving droplets and experience a combination of forces due to the internal fluid flow fields and external magnetic fields. We observed that this interplay of flow fields coupled to the formation of particle assemblies leads to the formations of stable patterns depending on the flow speed and magnetic field strength. An understanding of this dynamic assembly is critical in employing external forces for applications in separation and sorting.

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