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Magnetic self-assembly of microparticle clusters in an aqueous two-phase microfluidic cross-flow NIKI ABBASI, STEVEN G. JONES, BYEONG-UI MOON, SCOTT S.H. TSAI, Ryerson University — We present a technique that self-assembles paramagnetic microparticles on the interface of aqueous two-phase system (ATPS) fluids in a microfluidic cross-flow. A co-flow of the ATPS is formed in the microfluidic cross channel as the flows of a dilute dextran (DEX) phase, along with a flow-focused particle suspension, converges with a dilute polyethylene glycol (PEG) phase. The microparticles arrive at the liquid-liquid interface and self-assemble into particle clusters due to forces on the particles from an applied external magnetic field gradient, and the interfacial tension of the ATPS. The microparticles form clusters at the interface, and once the cluster size grows to a critical value, the cluster passes through the interface. We control the size of the self-assembled clusters, as they pass through the interface, by varying the strength of the applied magnetic field gradient and the ATPS interfacial tension. We observe rich assembly dynamics, from the formation of Pickering emulsions to clusters that are completely encapsulated inside DEX phase droplets. We anticipate that this microparticle self-assembly method may have important biotechnological applications that require the controlled assembly of cells into clusters.

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