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On-demand generation of aqueous two-phase microdroplets with reversible phase transitions CHARLES COLLIER, Oak Ridge National Laboratory — Aqueous two-phase systems contained within microdroplets enable a bottom-up approach to mimicking the dynamic microcompartmentation of biomaterial that naturally occurs within the cytoplasm of cells. Here, we demonstrate the on-demand generation of femtolitre aqueous two-phase droplets within a microfluidic oil channel. Gated pressure pulses were used to generate individual, stationary two-phase microdroplets with a well-defined time zero for carrying out controlled and sequential phase transformations over time. Reversible phase transitions between single-phase, two-phase, and core-shell microbead states were obtained via evaporation-induced dehydration and on-demand water rehydration. In contrast to other microfluidic aqueous two-phase droplets, which require continuous flows and high-frequency droplet formation, our system enables the controlled isolation and reversible transformation of a single microdroplet and is expected to be useful for future studies in dynamic microcompartmentation and affinity partitioning.

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