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A micro-PIV study on the internal flow within concentrated emulsion droplets flowing in a microchannel. CHIA MIN LEONG, Mechanical Aerospace and Nuclear Engineering, Rensselaer Polytechnic Institute, YA GAI, Aeronautics and Astronautics, Stanford University, SINDY K. Y. TANG, Mechanical Engineering, Stanford University — Droplet microfluidics has enabled a wide range of high throughput applications through the use of monodisperse droplets. Previous studies on the internal flow pattern of droplet microfluidics have mainly focused on a single drop. The study of concentrated emulsions is important for increasing the throughput, but the fluid dynamics of such emulsions in confined channels is not well understood. In this work, we use micro-PIV to probe the two-dimensional, mid-height flow inside individual drops within a concentrated emulsion. The emulsion has 85% volume fraction and flows as a monolayer in a microchannel. The effects of confinement and viscosity ratio on the internal flow patterns inside the drops were studied. The results show rotational structures inside the drops always exist and is dependent on the emulsion confinement and the droplet location in the channel. In addition, we show droplets involved in rearrangement event exhibit transient internal vortical structures, which arise due to the nature of concentrated emulsion and cannot be predicted by the flow in single droplet or diluted emulsion. To our best knowledge, no work has probed the flow field inside concentrated emulsion droplets at high volume fractions in confined channels. Current work is in progress to measure the three-dimensional flow field in such system.

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