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**Mixing in millimeter-scale drops by the action of surface viscosity**[1] FRANK RILEY, SHREYASH GULATI, AMIR HIRSA, Rensselaer Polytechnic Institute, JUAN LOPEZ, Arizona State University — Mixing within drops can be challenging as it involves low Reynolds numbers. Researchers have used techniques including electrowetting, acoustic, electric, magnetic, or mechanical excitation to produce mixing in drops for applications such as sample processing, pathogen detection and controlled reactions. Here we present a new strategy, namely the action of surface shear viscosity to produce mixing in drops. This was accomplished in a drop that is constrained between two rings: one of which rotates and the other can be counter-rotated or held stationary. Rotation of the ring causes interfacial shear which in turn drives bulk flow through the action of surface shear viscosity which can lead to a strong bulk flow. FEM-based models have been developed to predict the flow physics in the ring-sheared drop. Boussinesq-Scriven surface model has been used at the air-liquid interface. Mixing was studied for several configurations of the ring-sheared drop where the rings were rotated in steady, oscillatory and counter-rotating fashions. Prediction from the new model were tested against an established model that was experimentally validated.

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Frank Riley
Rensselaer Polytechnic Institute

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