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**Buoyancy-driven drop squeezing through a constriction** THOMAS RATCLIFFE, ALEXANDER ZINCHENKO, ROBERT DAVIS, Chemical and Biological Engineering, University of Colorado at Boulder, 424 UCB, Boulder, CO 80309 — Emulsion flow through a granular material is of fundamental importance to many applications (e.g., oil filtration through underground reservoirs). To understand these complex flow systems, the effect of drop squeezing on the emulsion flow rate and the critical conditions when the drops become trapped must be determined. As a related model problem, the buoyancy-driven axisymmetric motion of an emulsion drop through a torus is considered by experiments and by theory using a boundary-integral method. For the latter, the problem is reduced to a system of well-behaved second-kind integral equations for the fluid velocity on the drop and the Hebecker density on the solid surfaces (Zinchenko & Davis, 2006, *J. Fluid Mech.* vol. 564, pp. 227-266). During squeezing through the constriction, the trends for the drop-solid spacing (as small as 0.1-1% of the drop size) and the drop's velocity deceleration (up to  $10^4$  times) are explored in detail. A critical Bond number for trapping to occur is found for different squeezing conditions (drop-to-torus size ratio, drop-to-opening size ratio, and drop-to-surrounding fluid viscosity ratio). In experiments, our focus is to verify the predictions and to determine when surface roughness neglected in the theory has an effect on the squeezing process.

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