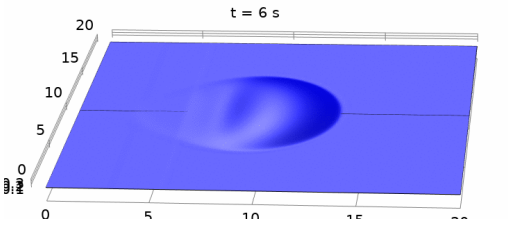
Phase Separation of Two-Fluid Mixtures using Surface Acoustic Waves

Advisors: Lou Kondic and Linda Cummings

The phase separation of multi-phase systems, particularly of oil-water and oil-water-surfactant mixtures, is significant for water recovery. We focus on a recently discovered acoustic-flow phenomena for active phase separation of multi-phase flows. The mechanism is based on low-power and high-frequency surface acoustic waves (SAWs), propagating in a solid substrate in contact with oil/water/surfactant mixtures. In particular, sound wave leakage off the SAW pushes emulsion droplets away from the solid substrate, and the acoustowetting effect further supports the extraction of oil or water by discriminating over their relative level of wetting of the solid substrate. The proposed research includes computations to elucidate the interplay between the different phase separation mechanisms. The computations will be directly validated by the experiment (carried out at Technion), and used to advance the experimental design, identify parametric regimes that support phase separation, and explain experimental results throughout the project. Our objective is to explore the basic principles for active multiphase flow separation under the action of SAWs to provide science for a low-cost approach to phase separation. The figure shows simulation of a spreading drop.



Support: ACS Grant (current); BSF Grant (current)