Phase Separation of Two-Fluid Mixtures using Surface Acoustic Waves

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The phase separation of multi-phase systems and in particular of oil-water and oil-water-surfactant mixtures is of significance 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), which propagate in a solid substrate in contact with oil/water/surfactant mixtures. In particular, sound wave leakage off the SAW will push emulsion droplets away from the solid substrate and the acoustowetting effect will further support 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 will be used to advance the experimental design, identify parametric regimes which will 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 the science for a low cost approach for phase separation.