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Dynamics in reactive bubbly flow PAVITHRA SUNDARARAJAN, DONALD KOCH, ABRAHAM STROOCK, Cornell University — Multiphase flow in microfluidic channels encompasses a rich collection of phenomena of widespread interest in both fundamental and technological context. While studies on non reactive multiphase flow focus on the dynamics of bubble breakup, coalescence and stability, a reactive multiphase flow opens up a broader spectrum of dynamics, like nucleation, growth and detachment of bubbles as well as the secondary mixing in the slugs during these processes. Our interest lies in the flow in an electrochemical microfluidic fuel cell with liquid reactants reacting at catalyst walls producing gaseous products which choke the fuel cell efficiency due to uncontrolled bubbly flow. This challenge is an opportunity in itself provided the multiphase flow dynamics can be characterized to achieve a stable Taylor regime. Taylor regime allows for promisingly high efficiencies due to improved mass transfer of reactants to the concentration boundary layer of the electrodes achieved by the secondary flow in the liquid phase present between bubbles. Here, I will experimentally explore the different regimes of reactive bubbly flow in a microchannel. The phase diagram of the reactive multiphase flows would be used to identify the stable regime for efficient fuel cell operation. Further, I will study the mass transfer in the presence of multiphase flow to regimes of enhanced mass transfer, and compare it with numerical models.

Pavithra Sundararajan
Cornell University

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