Engineering / Physics Seminar

Wednesday 10/17/2007, 4:30 pm
Science & Engineering Building Auditorium

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Investigation of the non-wetting potential of a droplet in a narrow channel with a gaseous passing flow

As the need for alternative power sources increases, fuel cells are gaining interest in the science and engineering community. In particular, space-travel strategies often rely on fuel-cell technology as a source of energy and water. Understanding the physics of the liquid/gas mixture in the small, manifolding flow passages inside fuel cells plays a key role in improving performance and reliability.

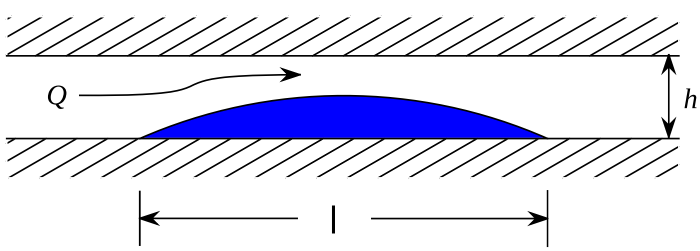

Figure. Illustration of a 2-D Droplet Inside a Channel

This masters-thesis research investigates the physics of a non-wetting water droplet in a narrow channel with a pressure-driven passing gas flow as shown below. In the figure, Q, l and h represent the gas flow rate, droplet length and channel height respectively. Both a theoretical and an experimental approach are ongoing.

The theoretical approach applies lubrication theory to a two-dimensional droplet and gas flow with an asymptotic approximation technique treating the ratio of the channel height to droplet length as a small independent parameter. Resulting simulations will be presented showing predicted liquid and gas flow fields and droplet shape.

The experimental approach establishes a quasi-two-dimensional droplet in a small channel and explores the influence of air velocity, channel height, and droplet volume on the stability and non-wetting potential of the droplet/channel interaction. Non-wetting has been demonstrated experimentally. Video images reveal deformed droplet profiles and a flow instability resulting in an oscillating flow inside the droplet and associated surface waves.

Please join us for light refreshments at 4:15pm outside SEB 203.