GRADUATE STUDENT RESEARCH SEMINAR SERIES (2021)

THE FLOW TRANSITION FROM INDUCED-CHARGE ELECTRO-OSMOSIS (ICEO) TO ELECTROTHERMAL FLOW (ETF) IN INSULATING DIELECTROPHORESIS (I-DEP) MICRODEVICES IN THE PRESENCE OF SHARP CORNERS

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The crucial component for numerous microfluidic particle-handling devices is controlling and manipulating the particles within the microchannels for focusing purposes. The electric field is the method of choice in these devices because of the precise transport and placement of particles via fluid electro-osmosis and particle electrophoresis. Insulator-based dielectrophoresis devices have been exploited for particle handling purposes, and sharp edges are an almost inevitable part of these types of structures. These sharp edges inside the microchannel may influence the flow by two nonlinear phenomena; induced-charge electro-osmosis (ICEO) and electrothermal flow (ETF) in the form of a pair of counter-rotating regional vortices near the sharp edges. Here, we have studied experimentally and numerically the transition from purely ICEO prevailing conditions (low fluid electric conductivity) to ETF prevailing conditions (high fluid electric conductivity). Moreover, a parametric study has been conducted to investigate the effect of various parameters on these two nonlinear phenomena competing with one another in the transition fluid conductivities.

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