Ph.D. Proposal Defense
Candidate: Anil B. Shrirao
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Time: 2:30 PM
Room: ECE 202

Title: High Aspect Ratio Electrodes For High Yield Electroporation Of Cells

Abstract: Electroporation is a widely used process in cell biology studies. It uses an electric field to create pores on the cell membrane in order to either insert exogenous molecules inside the cells or disrupt the cell membrane to kill the cells. Current micro-fluidic electroporation devices use the planar electrodes situated at the bottom of a microchannel. These planar electrodes i) require a high voltage and ii) generate a nonuniform electric field which result in low yield of the electroporation. The standard silicon microfabrication technologies are not suitable to fabricate non-planar electrodes required to increase the yield of electroporation.

We designed an electroporation device with an array of five pairs of non-planar three dimensional (3D) electrodes situated along the sidewalls of a microchannel. These 3D electrodes are fabricated by filling chosen microchannels with molten indium. The indium filling method allows the fabrication of microstructures with planar dimensions larger than ~30 µm regardless of their height, integrated into the PDMS device. The 3D electrodes generate a uniform electric field for electroporation using low voltage. The uniform electric field will avoid the limitations of planar electrodes by i) preventing cell death due to excessive electric field and ii) preventing lack of electroporation due to a low electric field. As a result, we expect these 3D electrodes to increase the yield of electroporation.

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