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Electrothermal Stirring for Heterogeneous Assays CARL MEINHART, UC - Santa Barbara, MARIN SIGURDSON — AC Electrokinetic effects are exploited to develop tools for improving response of lab-on-a-chip biosensors through augmenting transport in the sensor. This is applicable to immunoassays as well as DNA hybridization, and to a variety of formats, from microfluidic to microarray. AC electric fields in a microchannel or microcavity can generate forces on both the fluid itself, through AC electroosmosis and electrothermal forces, and on suspended particles through dielectrophoresis (DEP). The appropriate combination of these forces can concentrate or sort particles, or mix solutions. Here we describe the use of electrothermally generated flow in a microcavity to circulate suspended analyte past immobilized ligand to increase binding opportunities. A finite element model predicts the electrothermally generated force on the fluid, the subsequent fluid circulation, and the resulting increase in binding rate - up to a factor of eight for a heterogeneous immunoassay. The fluid velocity solution has been qualitatively corroborated by micro-PIV experiments using fluorescent tracing particles. The increase in binding rate has been tested through the reaction of fluorescently tagged streptavidin with biotinylated glass. Experimental results for increasing binding rate with electrothermal stirring are encouraging.

Carl Meinhart
UC - Santa Barbara

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