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AC Electrokinetic 3D blinking micro-mixer MARIN SIGURDSON, SOPHIE LOIRE, MARKO BUDISIC, IGOR MEZIC, UC Santa Barbara — An AC electrokinetic 3D mixer is presented, which has the potential to accelerate bioreactions in both lab-on-a-chip and microplate formats. AC voltage across electrodes on a micro-chamber floor generate vortices in the buffer via the electrothermal effect, which is particularly effective for ionic buffers used in bioassays. Controlling these vortices over time, for example, by periodic switching between overlapping vortices (blinking), creates time dependent 3D chaotic mixing. This mixing was studied via 2 methods. First, the full 3D, 3 component velocity field was measured with our original Proper Orthogonal Decomposition PIV method for each vortex configuration. These velocity fields were then used to numerically evaluate mixing predictive parameters such as ergotic quotient and fluid layering. These parameters help identify regions of good and poor mixing, aiding electrode shape design. Second, mixing of low and high diffusivity particles was optically evaluated, through the Mix Variance Coefficient. The blinking pattern and frequency was then optimized to yield the fastest mixing for each case. Finally, work is underway to demonstrate reaction rate acceleration on the order of 10 fold as the result of this mixing.

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