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AC electric field driven microfluidic control and mixing NICOLAS GREEN, HYWEL MORGAN, University of Southampton, ANTONIO RAMOS, ANTONIO GONZALEZ, ANTONIO CASTELLANOS, Universidad de Sevilla —
The AC electrokinetic movement of fluids has its origin in two different physical mechanisms: AC electroosmosis, the interaction of the Electrical Double Layer induced on microelectrodes by an applied potential and the generated electric field; and electrothermal Electro-hydrodynamics, the interaction of an electric field with gradients in polarisability of the fluid produced by non-uniform heating. Both mechanisms are dependent on a range of factors: applied voltage, signal frequency, fluid properties and the use of AC electric fields requires significantly less voltage ($\sim$10V) than DC electrokinetics, therefore presenting a range of different applications in microfluidic systems. This paper presents results of the use of AC electrokinetics for a range of applications in pumping, mixing and microfluidic control. Patterned microelectrode structures were used for rapid, switchable mixing of multiple fluid streams in microchannels, enhancing diffusive mixing. The mixing occurred over a short distance in the microchannel and could be switched on and off rapidly. Also presented is the use of AC electrokinetics for the local modification of streamlines and deflection of fluid streams in microchannels.

Nicolas Green
University of Southampton

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