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**Micro pumping methods based on AC electrokinetics and Electrorheologically actuated PDMS valves**[1] GAURAV SONI, TODD SQUIRES, CARL MEINHART, University of California, Santa Barbara — We have developed 2 different micropumping methods for transporting ionic fluids through microchannels. The first method is based on Induced Charge Electroosmosis (ICEO) and AC flow field-effect. We used an AC electric field to produce a symmetric ICEO flow on a planar electrode, called 'gate'. In order to break the symmetry of ICEO, we applied an additional AC voltage to the gate electrode. Such modulation of the gate potential is called field effect and produces a unidirectional pumping over the gate surface. We used micro PIV to measure pumping velocities for a range of ionic concentration, AC frequency and gate voltage. We have also conducted numerical simulations to understand the deteriorating effect of lateral conduction of surface charge on the pumping velocities. The second method is based on vibration of a flexible PDMS diaphragm actuated by an electrorheological (ER) fluid. ER fluid is a colloidal suspension exhibiting a reversible liquid-to-solid transition under an electric field. This liquid-to-solid transition can yield very high shear stress and can be used to open and close a PDMS valve. Three such valves were fabricated and actuated in a peristaltic fashion in order to achieve positive displacement pumping of fluids.

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