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Programmable Electro Osmotic Lab on a Chip ANDREAS G. CLASS, Karlsruhe Institute of Technology — We propose to use a 2D check-board patterned surface with alternating zeta potential made of semiconductors and individually controllable electrodes surrounding each field to drive by electro osmosis an arbitrary flow along the surface within the cavity of a lab-on-a-chip. In contrast to other fluid mechanic devices the flow is not driven by pressure gradients but rather by a controllable fluid velocity within the Debay boundary layer. Thus fluid is transported like a parcel on a conveyor belt. The use of alternating zeta potential fields and alternating electrode polarities allows to transport flow along multiple fields without the need to increase voltage. Basic functionality of the chip is accomplished by appropriate programming: fluid transport along straight and curved path, merging and splitting flow paths, flow crossing by red light traffic control, and mixing. Implementing sensors for electric resistance on the Lab-On-A-Chip allows to program a diagnosis application using electrophoresis for detection. Transport within the Lab-On-A-Chip can be described by Stokes-flow subject to the boundary conditions given by asymptotic theory in the thin-Debay-layer-limit describing field driven electro kinetic effects.

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