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Surface Acoustic Wave Transport and Mixing in Fluids in an Enclosed Nanoslit MORTEZA MIANSARIGAVZAN, JAMES FRIEND, University of California, San Diego — Non-laminar fluid flow was generated in a nanoslit using 20 MHz surface acoustic waves. A novel acoustic nanofluidic device was fabricated by a unique room-temperature, high-strength bonding method combining a 128-YX lithium niobate (LN) substrate with a second LN substrate containing a 1-cm long, 50–300-nm thick, 400 μm-wide planar nanoslit. The nanoslit was verified to be extremely smooth (roughness < 5 nm) and possess a uniformly rectangular shape. Despite an exceptionally low ($\sim 10^{-5}$) hydrodynamic Reynolds number within the nanoslit, acoustic streaming induced by the SAW is found to drive filling of the *hydrophilic* nanoslit greatly in excess of the typical Washburn capillary filling rate, a unique ability to completely *drain* the hydrophilic nanoslit of fluid, induce rapid mixing of fluid within, and drive nanoparticle and early evidence of molecular separation from the fluid at the nanoslit exit as the fluid passes through. The unique physical phenomena may prove to be useful across a broad range of applications where it facilitates the use of nanofluidics in chemistry and medicine. It illuminates an extraordinary ability to use sound at ever smaller scales to manipulate fluids and particles within in unexpected ways.

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