Supplemental Information

Electromagnetic Micropores: Fabrication and Operation

Pyrex Chip fabrication
Pyrex wafers were spin-coated with a double-layer resist system (lift-off resist LOR-1A over coated by SPR 220-7.0) and micro-coil and pad areas were photolithographically defined. Titanium (15 nm) and gold (200 nm) were deposited onto the surface with an e-beam evaporator. Subsequent lift-off resulted in a trap seed layer. Coil and pad areas were again defined (SPR 220-7.0). Here, the photoresist acted as a mold above the coil seed layer to allow for electrodeposition of 3-4 μm of gold (Figure 1d.). Gold coil thicknesses were determined with a contact profilometer (Dektak, Veeco Inc).

ESI 1. Gating Experimental setup a chip is mounted between two compartments of a test cell (a) a rare earth magnet is placed directly below apparatus. (b) Each compartment contains a solution of KCl and Ag/AgCl electrodes (c) Ion current is monitored while energizing the coil with a secondary power source (d-e respectively).
ESI 2. Finite element simulations of the 100 µm coil (a) and 20 µm coil (b). The current through the coil used in these simulations was 300 mA. Magnetic fields simulated at slices through the center of the coil, and at various heights above the coil is shown.
ESI 3. Finite element simulations of the 100 μm coil within a 2.5 mT external magnetic field. Magnetic fields simulated at slices through the center of the coil, and at various heights above the coil is shown: 300 mA clockwise current simulated (a); 300 mA counterclockwise current simulated (b); schematic depicting the direction of the magnetic field produced by a coil with a clockwise (c) and counterclockwise (d) current.
ESI 4. Ion current vs time. The black and blue traces, respectively, are the control (no ferrofluid droplet) and gating (ferrofluid droplet) experiments, where a 0.01 Hz triangle wave (800 mA $I_{pp}$) runs through a 100 µm coil. The red trace represents gating, where a 0.01 Hz square wave (800 mA $I_{pp}$) runs through the 100 µm coil. The numbers within the plot represent the corresponding currents running through the trap during the triangle wave. Positive currents are travelling counterclockwise and a negative currents are travelling a clockwise. A 1 M KCl solution was used. This plot is a portion of the plot shown in Figure 6c (0-175 s).