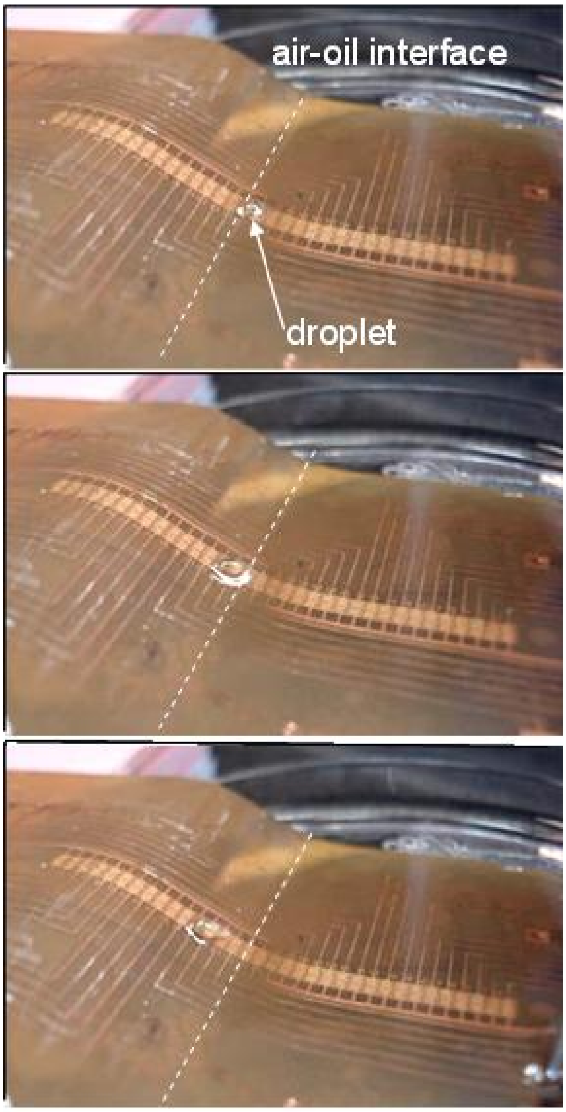
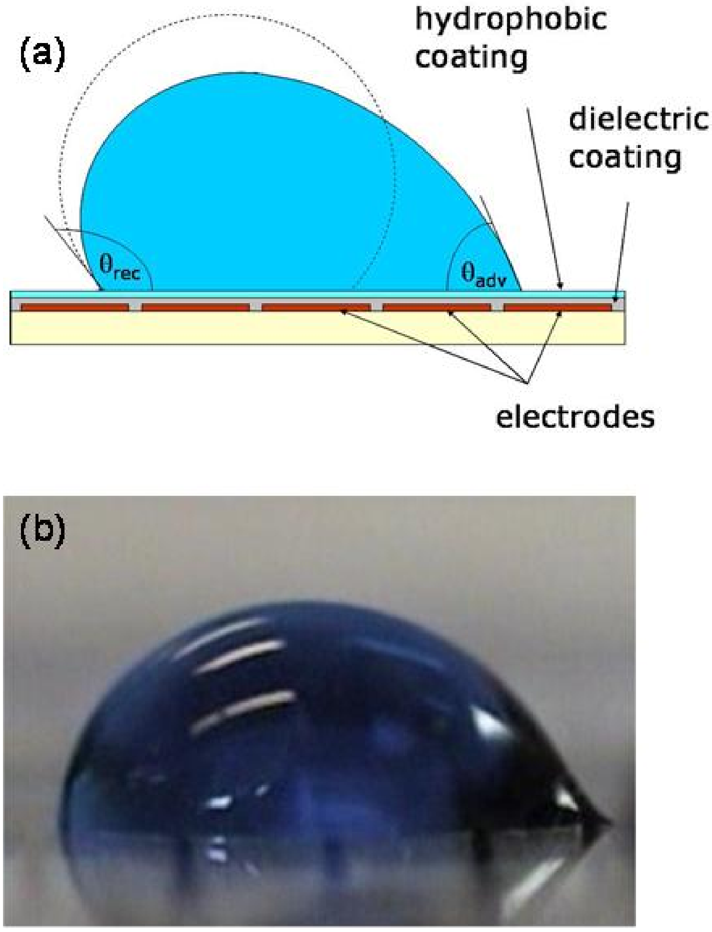
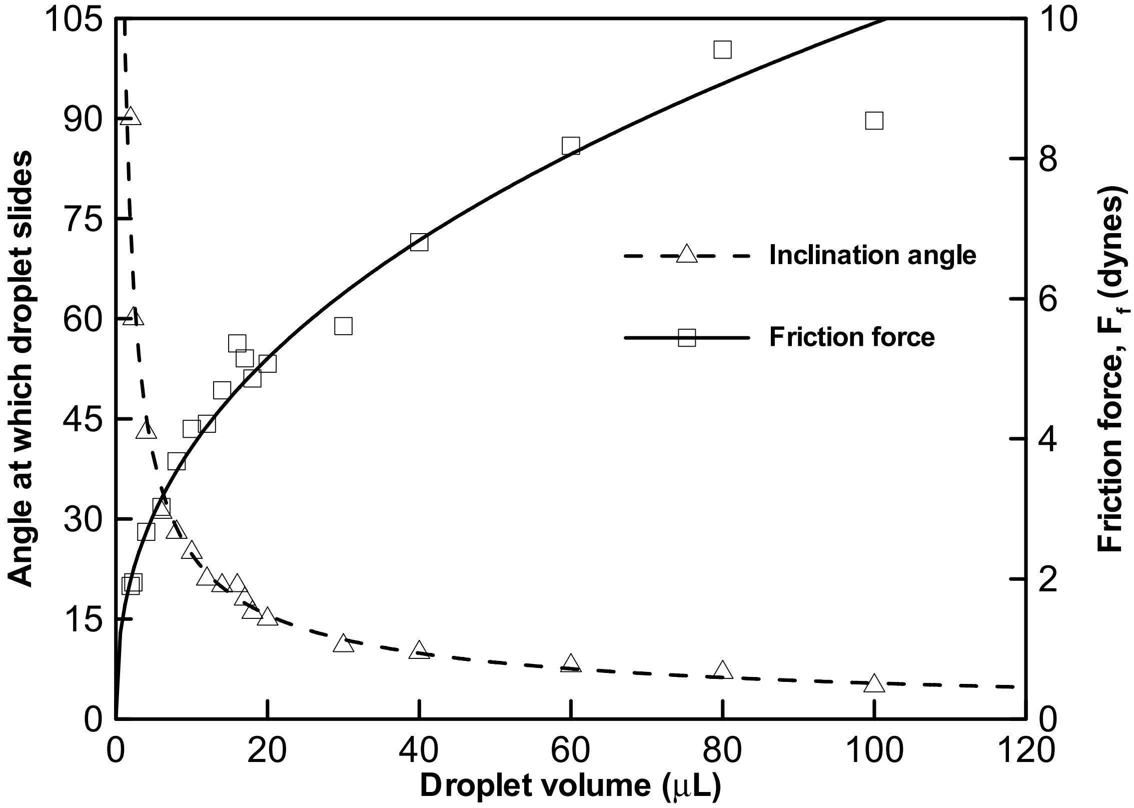


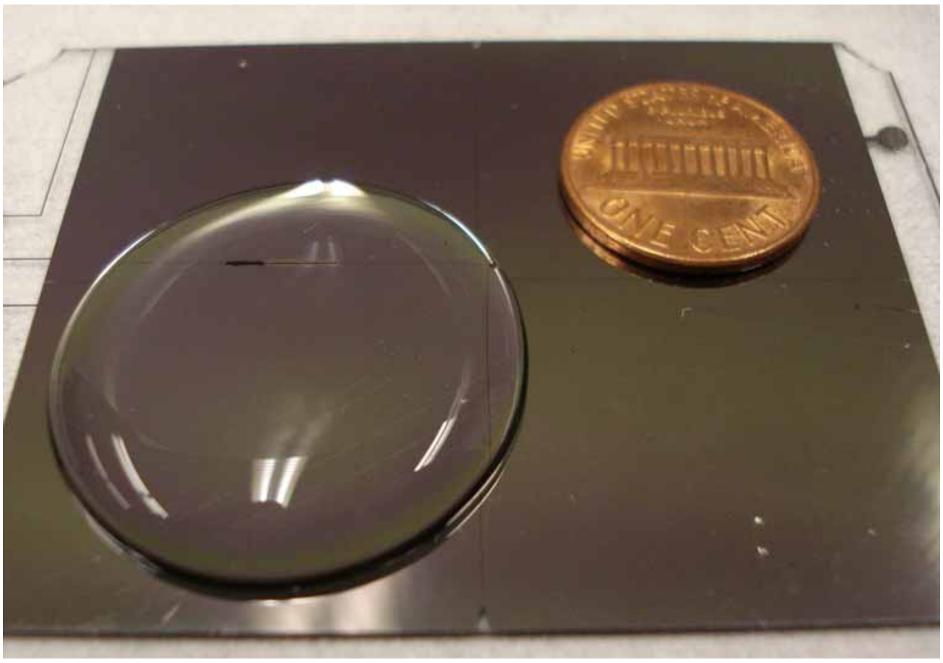

**Supplementary Figure S1** Sequence of frames from a movie (top to bottom) depicting ATDA-driven manipulation of a droplet of water through an interface between silicone oil and air.




**Supplementary Figure S2** **a** Schematic and **b** picture of contact angles on actuated ($\theta_{adv}$) and non-actuated ($\theta_{rec}$) electrodes. In this work, the minimum and maximum contact angles were $\theta_{adv}$ = 68° and $\theta_{rec}$ = 115°, respectively. Note that the picture in **b** does not reflect these values.




**Supplementary Figure S3** Approximation of static friction forces. Angle data (open triangles) were generated by pipetting droplets of different volumes onto coated surfaces, and observing the angle at which the droplets slid. Angle data were used to calculate friction force data (open squares), which were fit with a power function, $F_f = e^{(0.4084 \ln(V) + 0.4153)}$, where $F_f$ is the friction force in dynes and $V$ is the droplet volume in microliters.




**Supplementary Figure S4** Droplets as large as 2.8 mL (29.5 mm in diameter) were movable on an array of 4 electrodes (25×30 mm each). We note that at such large volumes, the ATDA model loses some accuracy as some of the assumptions used in its formulation are no longer true. For example, viscous friction can be no longer neglected for such large droplets, and the droplet shape cannot be assumed to be a spherical cap.