Supporting Information

Reconfigurable Positioning of Vertically-Oriented Nanowires Around Topographical Features in an AC Electric Field

*Sarah J. Boehm,[§] Lan Lin,[†⊻] Nermina Brljak,[§] Nicole R. Famularo,[§] Theresa S. Mayer,[†‡] and Christine D. Keating[§]**

Departments of §Chemistry and †Electrical Engineering, The Pennsylvania State University, University Park, Pennsylvania 16802, United States. ‡Virginia Tech University, Blacksburg, Virginia 24060, United States.

*Address correspondence to keating@chem.psu.edu

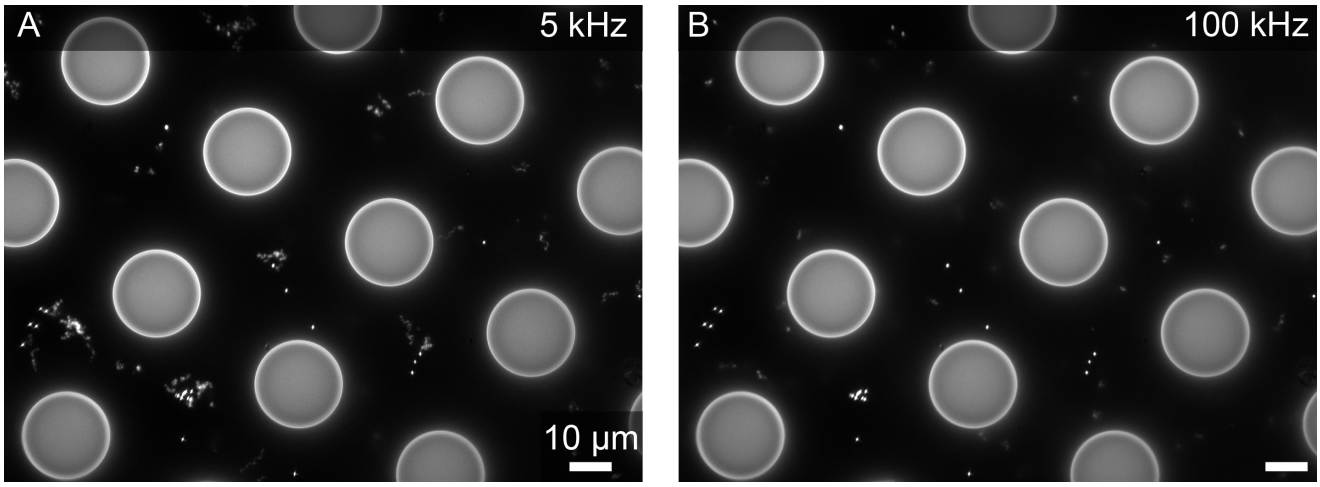

Figure S1. Electric field assembly of 210 nm diameter polystyrene spheres in deionized water (Fluoresbrite Yellow Green Polystyrene from Polysciences Inc.). (A) At 5 kHz, fluorescent tracer particles accumulated in stagnation points between posts due to electrohydrodynamic (EHD) flow of the suspending medium. (B) At 100 kHz, the spheres diffused freely in solution. (Note, some particles stuck to the substrate surface and therefore did not move between frames). Applied voltage was 833 V/cm in all panels. See also associated Movie S2 showing the effect of applied AC electric field upon these fluorescent tracer particles.

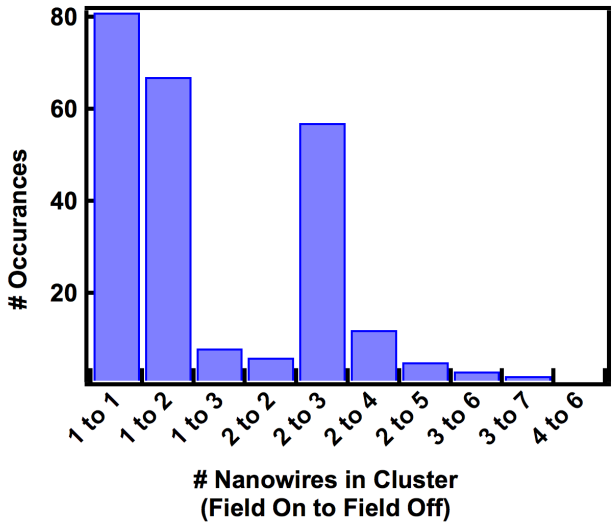

Figure S2. Quantification of 2.5 μm gold nanowire clusters with the field on and off for sample with no patterned features. Field strength was 330 V/cm, 750 kHz. Classifications contain two numbers, where the first is how many wires a cluster appears to be when the field was on, and the second is how many wires fell down from that same cluster when the field was turned off.

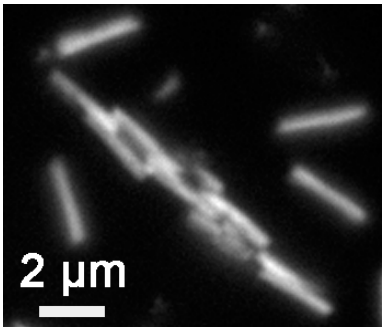

Figure S3. Reflected light optical microscope image of a nanowire chain that persisted after the field was turned off in an experiment where no patterned posts were used and the vertical field was left on for >2 hours at 830 V/cm, 10 MHz.

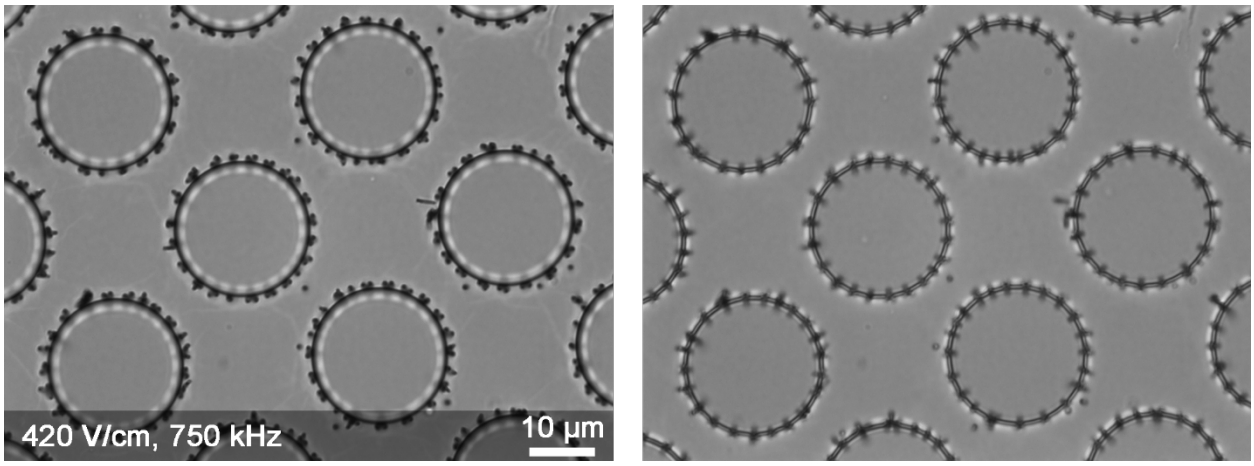

Figure S4. Assembly of 2.5 μm long gold nanowires around patterned posts. Left: Image was focused on the substrate surface. Right: Image was focused on the top of the posts to show particles aligned along the rim of the posts.

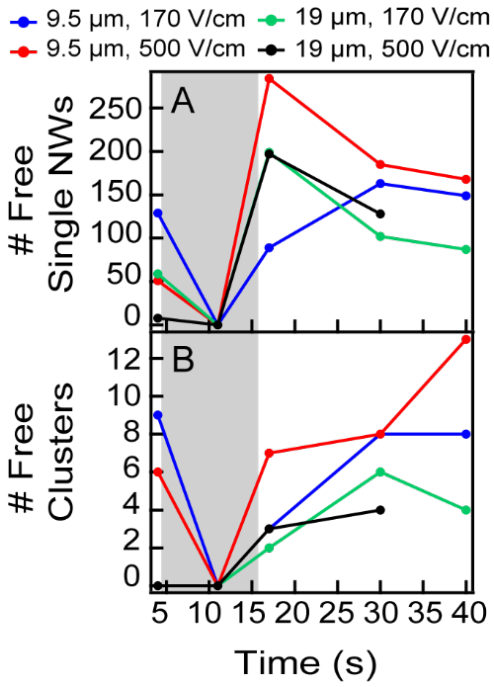

Figure S5. Analysis of experimental Movies S1, S3-S5. The region of the plot where the field was off is highlighted by the grey box. Still frames at five time points were examined by counting the number of standing nanowires categorized in two ways: average number of (A) single nanowires and (B) clusters, freely standing (not around a post). Red and blue traces correspond to 9.5 μm diameter posts at 170 and 500 V/cm, respectively. Green and black traces correspond to 19 μm diameter posts at 170 and 500 V/cm, respectively. Note, black trace stops at 30 s because fewer frames were collected for Movie S4.

Movie Descriptions

For all six movies, scale bars are 10 μm. The description of Movie S1 also applies to S3 through S6 with the exception of the specific electric field conditions and post dimensions.

Movie S1. The electric field was on for >2 minutes prior to movie collection. t = 0 s corresponds to the start of the movie. The field was turned off at 5 s and turned back on at 16 s. Field conditions were 500 V/cm, 750 kHz. Post diameter and spacing: 9.5, 11.0 μm, respectively.

Movie S2. Movement of 210 nm diameter fluorescent polystyrene tracer particles illustrates electrohydrodynamics-driven accumulation of tracer particles between each set of four posts. The electric field was off for ~ 1 minute prior to movie collection. The voltage was 833 V/cm when the field is on, the frequency varies as labeled in the video. Post diameter and spacing: 19, 21.6 μm, respectively.

Movie S3. Field conditions were 170 V/cm, 750 kHz. Post diameter and spacing: 9.5, 11.0 μm, respectively.

Movie S4. Field conditions were 500 V/cm, 750 kHz. Post diameter and spacing: 19, 7.7 μm, respectively.

Movie S5. Field conditions were 170 V/cm, 750 kHz. Post diameter and spacing: 19, 7.7 μm, respectively.

Movie S6. Field conditions were 330 V/cm, 750 kHz. Post diameter and spacing: 19, 7.7 μm, respectively.