Supporting Information

1. Experimental Details

(1) Preparation of monolayer

① Silicon substrate (5-mm × 5-mm × 0.3-mm) was cleaned with deionized (DI) water and acetone. To remove natural oxide layer, the cleaned substrate was immersed in HF solution (HF/H_2O = 1:10, v/v) for 1 min. Surface of the substrate was hydroxylated in piranha solution (H_2SO_4/H_2O_2 = 2:1, v/v, 80 ^oC) for 30 min.

② The silicon substrate was then immersed in 0.1 M OTS solution for 1 h and rinsed with DI water and acetone.

(2) SPL condition

① Cantilever: Cr-Pt-coated silicon, 13 kHz, 0.2 N/m (BudgetSensors, BS-ElectriCont)

② Tip bias voltage: -9.9 V with respect to sample

③ Lithography speed: 0.2 μm/s

④ Humidity: 40 ~ 60 %

(3) Implanting APS

The patterned substrate was immersed in 0.1 M APS solution for 30 min, followed by sonicating with toluene and rinsing and with DI water and acetone .

(4) Combing

① λ-DNA: 48,502 base pair, supplied in 10 mM Tris-HCl (pH 8.0) and 1 mM EDTA (BioLabs, N3011L)

② DNA concentration for the combing: 2 μg/mL (Figure 2) or 0.2 μg/mL (Figure 3), diluted with tris-HCl buffer (pH 8.0)

③ 500 μL of the diluted DNA solution was transferred into a 9-mm-inner-diameter tube.

④ Custom-made dipping/pulling machine; the translation direction is exactly parallel to the side edges of the substrate and the patterned lines; the optimal combing speed: 50 μm/s for the residing air/water meniscus

(5) Staining with positively charged gold nanoparticles

① To synthesize gold nanoparticles, 1 mL of 0.1 M aniline was added to 25 mL of 0.03 wt% $HAuCl_4$ and the solution was stirred for 20 min at 80 ^oC.

② The stock solution was centrifuged at 15,000 rpm for 30 min at 5 ^oC.

③ 500 μL of the upper aliquot was transferred into the test tube.

④ The sample substrate was treated in the same way as the DNA combing.

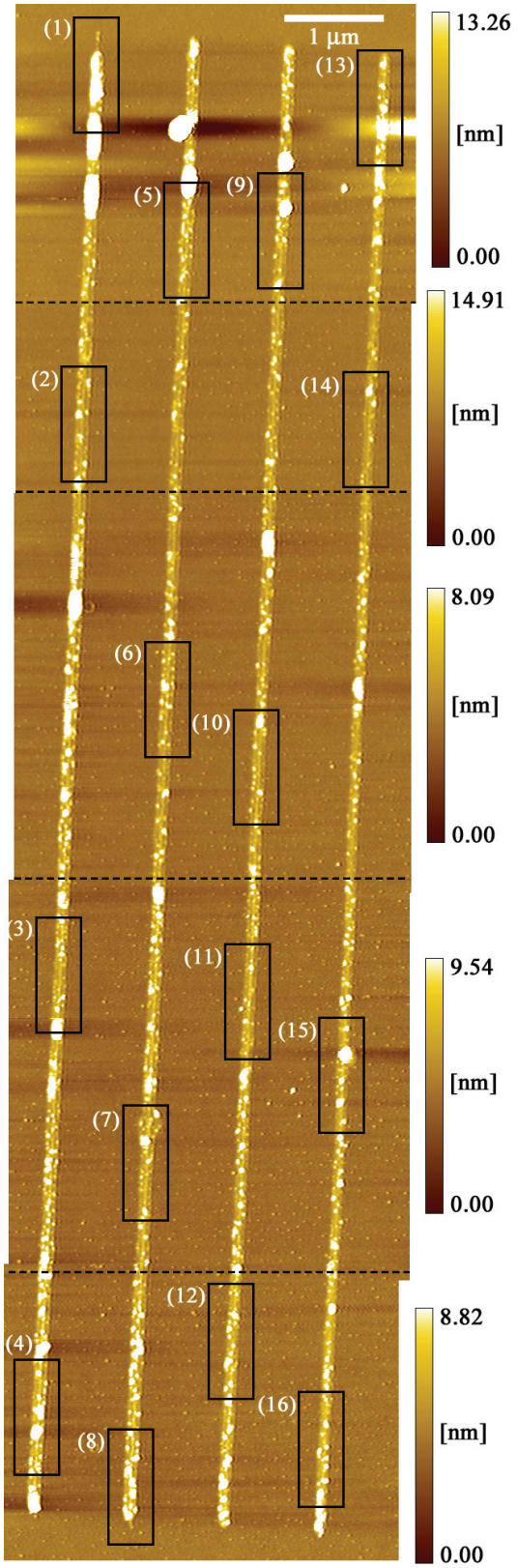
(6) Condition for tapping-mode AFM

① Cantilever: Al-coated silicon, 315 kHz, 14 N/m (Mikromasch, NSC12/B)

② Scan speed: 8.00 μm/s (Figures 2, 2S, 3S-bottom ones) or 22.4 μm/s (Figures 3 and 3S-upper one)

2. Details of Figure 2 and Figure 3

Shown in Figure 2S and 3S in the next two pages, respectively



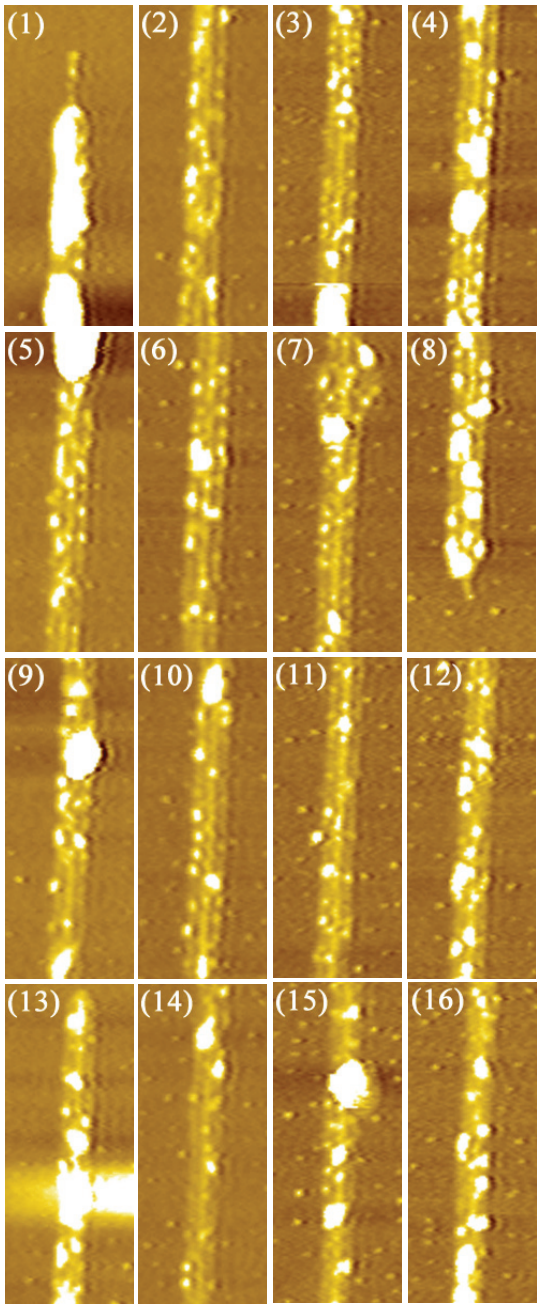


Figure 2S. Details of Figure 2. The left figure is explained in the main paper. Each blocked area in the left figure is magnified to be exhibited in the right. Fifth line was also examined at higher resolution and showed the same trend as the left four lines (not shown).

Figure 3S. Details of Figure 3. Each blocked area in the upper figure was scanned with a finer resolution and exhibited below.