Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

High-sensitivity imaging with lateral resonance mode atomic force microscopy

Ren-Feng Ding[a,b], Chih-Wen Yang[*a], Kuang-Yuh Huang[b] and Ing-Shouh Hwang[*a]

[a] Institute of Physics, Academia Sinica, 11529, Taipei, Taiwan

[b] Department of Mechanical Engineering, National Taiwan University, 10617, Taipei, Taiwan

E-mail: yangcw@phys.sinica.edu.tw; ishwang@phys.sinica.edu.tw

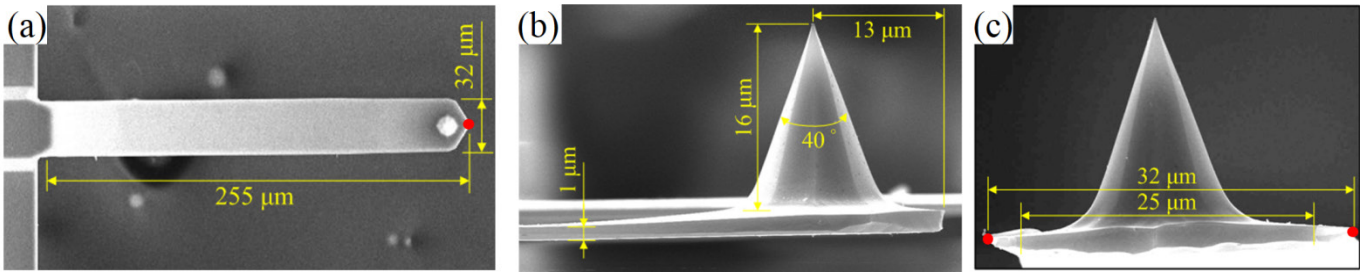


Figure S1. Scanning electron microscopy of a MicroMasch CSC38/Cr-Au_A cantilever. (a) Bottom view. (b) Side view. (c) Front view of the cantilever tip. The measured dimensions were used in finite element analysis.

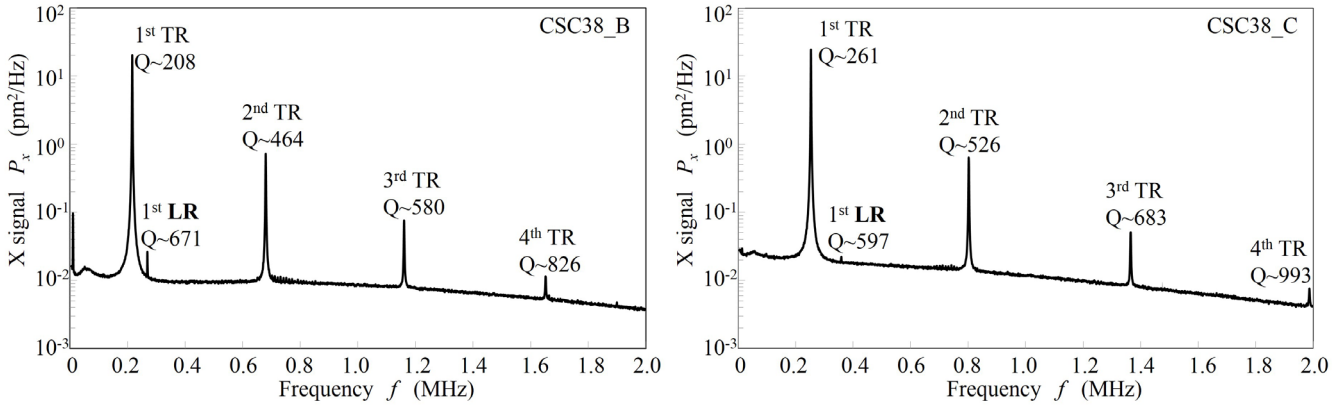


Figure S2. Thermal noise spectra of the X signal measured in air on the free end of cantilevers CSC38_B (a spring constant of ~0.03 N/m, dimensions 350 μm × 32 μm × 1.0 μm) and CSC38_C (a spring constant of ~0.05 N/m, dimensions 300 μm × 32 μm × 1.0 μm) .

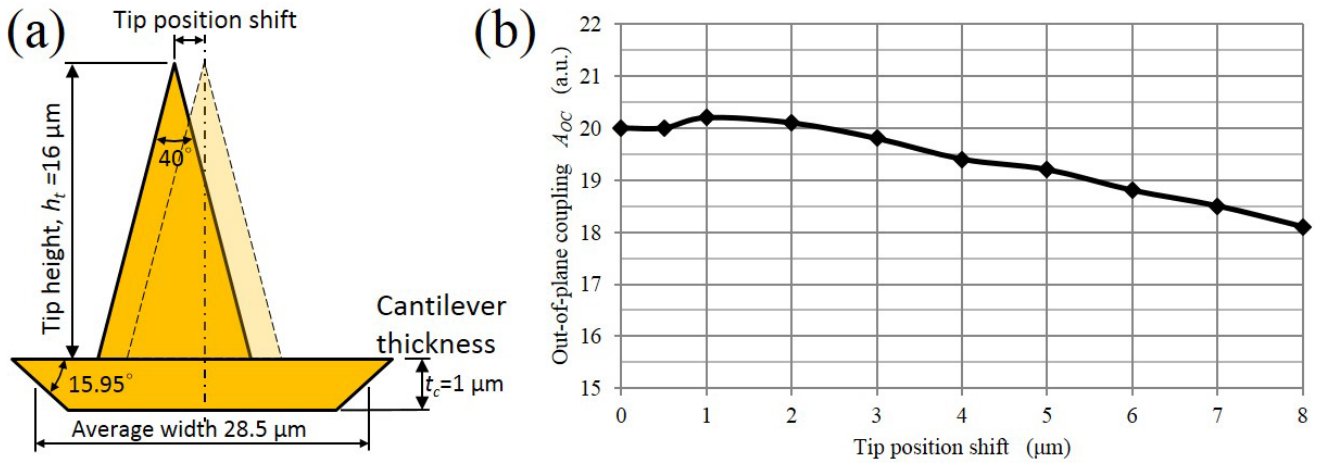
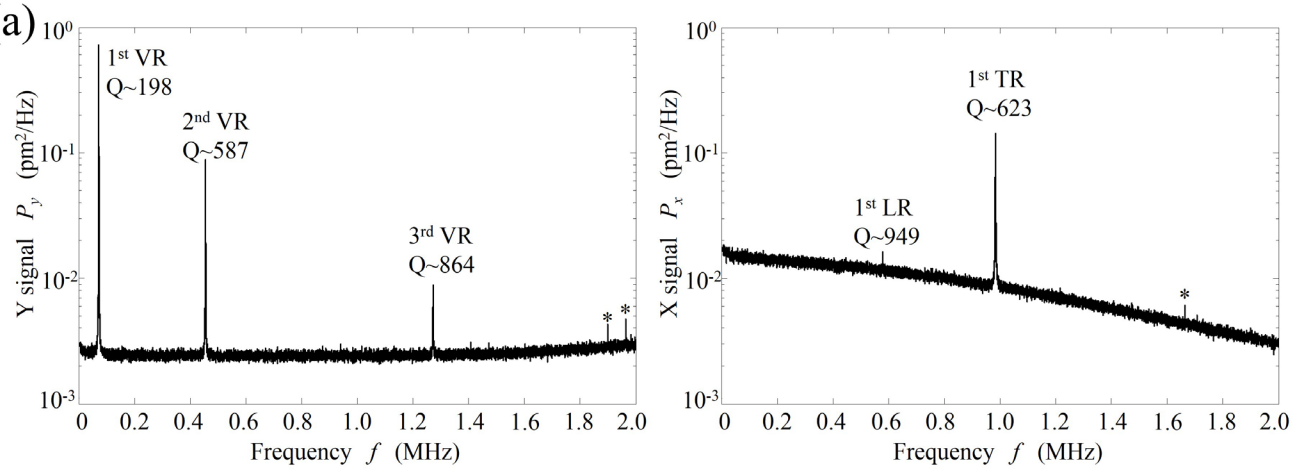


Figure S3. Simulation of out-of-plane coupling versus the tip position shift from the long axis of the cantilever. (a) Simulation model of a Si cantilever (front view). (b) Simulation of out-of-plane coupling versus the tip position shift from the center.

(a)



(b)

	1st VR	2nd VR	1st LR	1st TR	3rd VR
Measured frequency (kHz)	72.4	455.3	579.7	983.4	1271.9
FEA calculated frequency (kHz)	64.0	400.2	567.2	1013.6	1116.5

Figure S4. Mechanical resonances of a PPP-FMAuD cantilever (NANOSENSORS, spring constant ~2 N/m). (a) Thermal noise spectra of the Y and X signals measured in air on the free end of the cantilever. (b) Measured and FEA-calculated resonance frequencies of the cantilever.

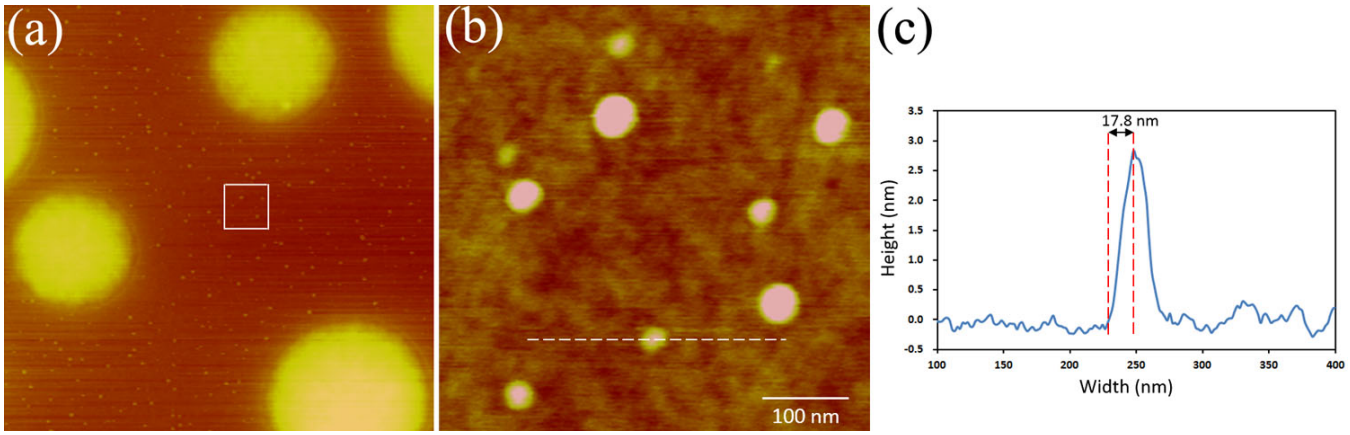


Figure S5. LR mode AFM imaging of a heterogeneous blend of polystyrene and LDPE in air using a PPP-FMAuD cantilever. The working frequency was ~574 kHz; *Q*~949. The feedback setpoint was 85% of the free oscillation amplitude. (a) Topographic image of 5 μm × 5 μm. Scan rate was 0.8 Hz/line. (b) Higher-resolution image acquired inside the white box in (a). Scan rate was 1.0 Hz/line. (c) Height profiles along the dashed line in (b). The spatial resolution of the image can be estimated to be better than 15 nm based on the sharp rise of the height profile.