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Tuning the Spring Constant of Cantilever-free Probe Arrays DANIEL J. EICHELSDOERFER, KEITH A. BROWN, RADHA BOYA, Northwestern University Department of Chemistry and International Institute for Nanotechnology, WOOYOUNG SHIM, Northwestern University Department of Materials Science and Engineering, CHAD A. MIRKIN, Northwestern University Department of Chemistry, Department of Materials Science and Engineering and International Institute for Nanotechnology — The versatility of atomic force microscope (AFM) based techniques such as scanning probe lithography is due in part to the utilization of a cantilever that can be fabricated to match a desired application. In contrast, cantilever-free scanning probe lithography utilizes a low cost array of probes on a compliant backing layer that allows for high throughput nanofabrication but lacks the tailorability afforded by the cantilever in traditional AFM. Here, we present a method to measure and tune the spring constant of probes in a cantileverfree array by adjusting the mechanical properties of the underlying elastomeric layer. Using this technique, we are able to fabricate large-area silicon probe arrays with spring constants that can be tuned in the range from 7 to 150 N/m. This technique offers an advantage in that the spring constant depends linearly on the geometry of the probe, which is in contrast to traditional cantilever-based lithography where the spring constant varies as the cube of the beam width and thickness. To illustrate the benefit of utilizing a probe array with a lower spring constant, we pattern a block copolymer on a delicate 50 nm thick silicon nitride window.

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