Single-walled carbon nanotubes (SWNTs) were attached to the pyramids of gold-coated microfabricated silicon cantilever-tip assemblies (FESP (k = 0.5-5 N/m), Digital Instruments, Inc., Santa Barbara, CA) under the direct view of an optical microscope using dark field illumination. Key steps taken in mounting the SWNTs are as follows. First, the silicon pyramid is coated with an acrylic adhesive by contacting and then retracting the tip from a clean portion of carbon tape (adhesive carbon tape, Electron Microscopy Sciences, Fort Washington, PA). Second, the pyramid is brushed against an isolated portion of a SWNT rope. Last, the tip is retracted to pull the rope free from the supporting tape and/or other SWNTs.

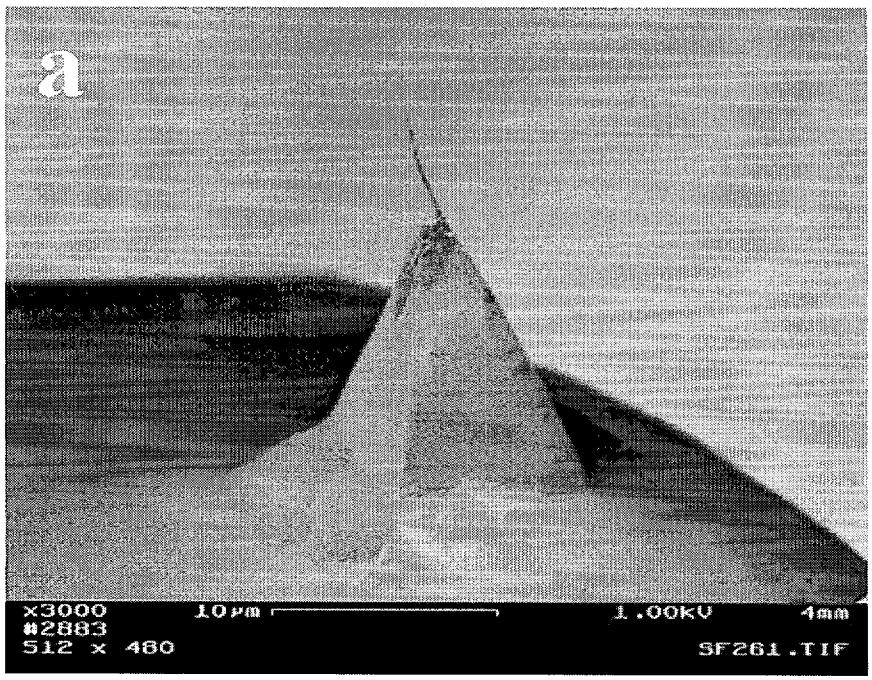
As-made SWNT tips are typically too long for high-resolution imaging and must be shortened. The SWNT tips were shortened by applying a bias voltage (0.5-20 V) between the tip and a sputtered Nb surface (Nioprobe, Electron Microscopy Sciences, Fort Washington, PA), while the tip was oscillated at a frequency of 50-75 kHz and an amplitude of 20-100 nm. The applied bias creates a momentary arc that shortens the SWNT tip, and also etches and sharpens the end of the tip. Tapping mode images of the Nb surface were used to assess qualitatively the sharpness of the tip.

The SWNT tips were characterized by electron microscopy and gold colloid standards. Field-emission scanning electron microscopy (LEO 982, Leo Electron Microscopy, Inc., New York) showed that as made SWNT tips had lengths of ca. 1-10 μm (Fig. 1). Shortened SWNT tips, which exhibited good resolution, typically had lengths of 0.5-1.5 μm. The radii of curvature of these tips were determined from images of 5 nm gold colloids (Ted Pella, Redding, CA) as described previously.[2] The radii were found to range from 3-10 nm; we believe that additional work on tip sharpening is clearly needed to take full advantage of the potential of SWNT tips. Lastly, transmission electron microscopy (Philips EM420T) images of the ends of shortened SWNTs show that the ends are open (Fig. 2).

Figure Captions: Supporting Information

Figure 1. Field-emission scanning electron microscopy images of a SWNT tip attached to the gold-coated silicon pyramid of a FESP tip. (a) Low-resolution view of cantilever end, silicon pyramid and attached SWNT rope. (b) Higher resolution image of the pyramid end and nanotube tip. Both images were recorded with accelerating voltage of 1 kV.

Figure 2. Transmission electron microscopy images of the end of a shortened SWNT rope. (a) Image of the end region of the SWNT tip. The scale bar corresponds to 10 nm. (b) High-resolution view of the tip end. The arrow highlights one of the open SWNTs in the rope. The separation between lines is 1.5 nm. The inherent flexibility of SWNTs required that a relatively large rope be used to obtain these high resolution TEM images.



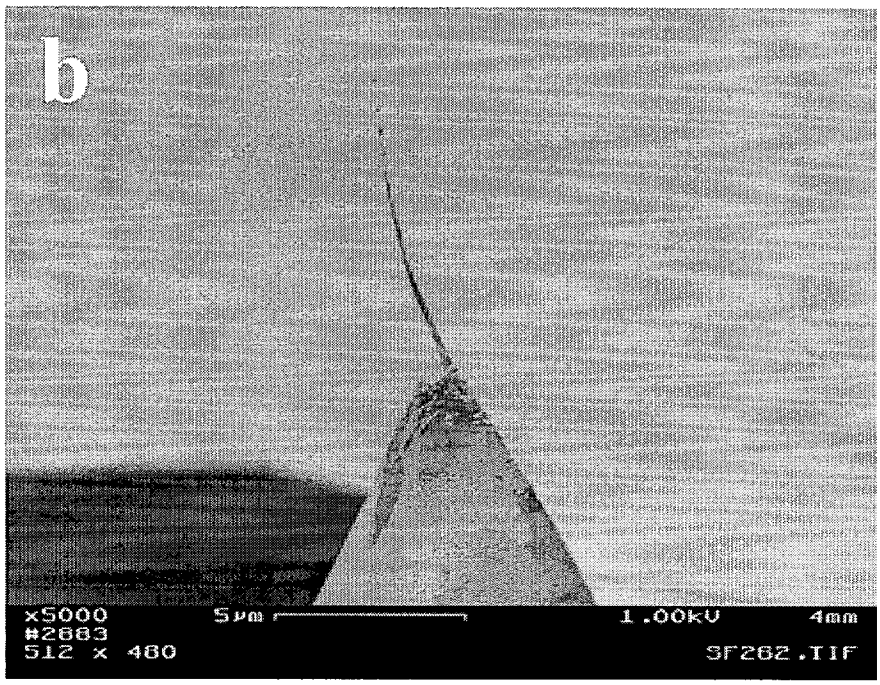


Fig. 1

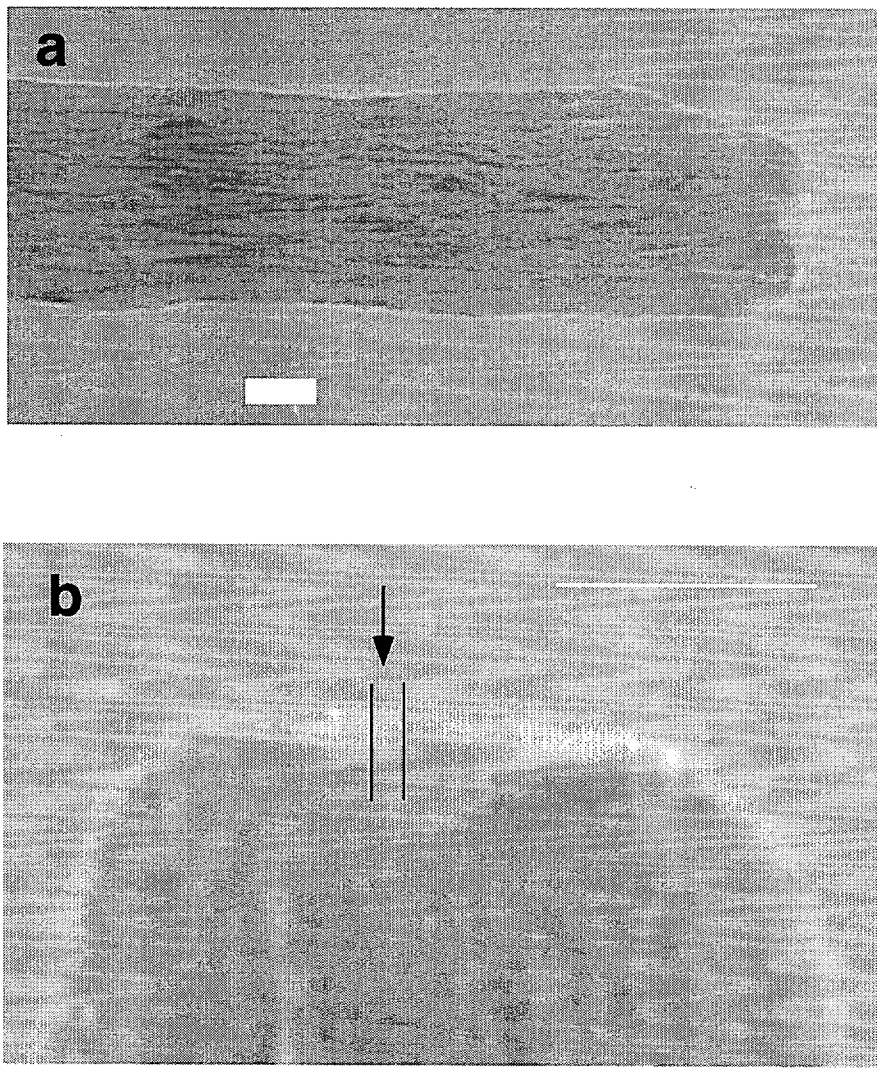


Fig. 2