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# Fabrication of ultra-sharp tips from carbon fiber for scanning tunneling microscopy investigations of epitaxial graphene on 6H-SiC(0001) surface

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Abstract

The fabrication of ultra-sharp tips from carbon fiber (CF), which are mounted on a qPlus probe for combined dynamic scanning tunneling microscopy (STM) and frequency modulation atomic force microscopy (FM-AFM) experiments, is reported. The carbon fiber tips were electrochemically etched in a KOH or NaOH solution, using different electronic devices. CF tips with an apex radius ~10 nm, as deduced from the measured slopes of the Fowler–Nordheim plots ($kR < 70$ nm for $k \sim 6$), were routinely obtained with a homemade electronic device that controls the intensity of the etching current. Then, these conductive CF tips were also characterized by imaging the 6H-SiC(0 0 0 1) surface covered by an epitaxial graphene layer in ultra-high vacuum (UHV). The lattice of the R30° reconstruction was regularly imaged by STM working either in non-oscillating mode or in dynamic mode, which also maps the variations of the force gradient. From these measurements with a constant mean-tunneling-current of 20 pA, it was found that the STM tip suffered variations of the tip/surface force gradient in between 8.25 and 16.50 N/m when it scanned the epitaxial graphene layer on the reconstructed 6H-SiC(0 0 0 1) surface.