Scanning enhancement of STM-tungsten probes by applying colloidal graphite coatings

Mohammad M. Allaham[1,2] and Alexandr Knápek[2]

Central European Institute of Technology, Brno University of Technology, Purkyňova 123, 612 00 Brno, the Czech Republic.
Institute of Scientific Instruments of Czech Academy of Sciences, Královopolská 147, 612 64 Brno, the Czech Republic.
Corresponding author: allaham@isibrno.cz

Scanning tunneling microscopy (STM) is performed using a needle-shaped probe of an ultra-sharp nanotip. The probe should be made from a material of good conductivity such as tungsten, gold, or platinum/iridium thermocouples. To perform an STM scan, the nanotip is brought to a distance of ~ 1 nm close to the tested sample surface, which should be of good conductivity too [1-5].

Tungsten cold field emission nanotips are known for their excellent performance as STM-probes. However, their performance is limited when the STM scan is performed in ambient gas pressure, or without in-situ cleaning of the tip. The performance of an uncoated tungsten tip of 70 nm in diameter is presented in Fig.1(a), where it shows that the probe tip was destroyed after scanning of 5×12 μm^2 area. Moreover, the figure shows that the tip was approached to the surface by ~ 900nm, which cause scratching the sample surface and destroying the tip.

To solve this problem, another tungsten tip of the same diameter was coated by a thin layer of conductive graphite paint. The graphite microflakes were dissolved inside isopropanol and the tip was dipped inside the solution. This process produced a tungsten-graphite composite probe of enhanced conductivity, and its performance is presented in Fig.1(b). The result shows a full scan for a region of 20×20 μm^2 and the sample was found in good conditions after the scan process.

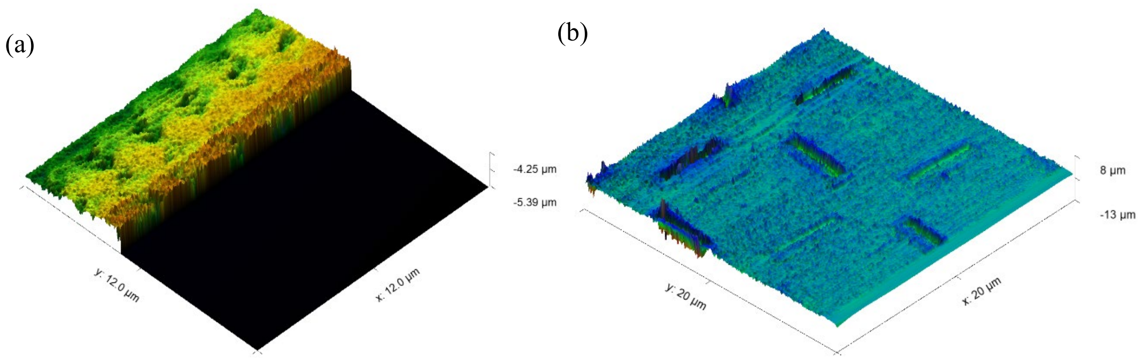

Figure 1. Scanning tunneling microscopy scan for two reference samples obtained from (a) uncoated tungsten probe, and (b) tungsten-graphite composite probe.

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