Local Deformation of 2D materials by dual-probe AFM/STM

Stefan Hummel
K. Elibol, B.C. Bayer, J. Kotakoski, J.C. Meyer

Physics of Nanostructured Materials,
University of Vienna
Boltzmanngasse 5
1090 Vienna, Austria

stefan.hummel@univie.ac.at

Abstract

Scanning probe microscopy (SPM) techniques are one of the most important experimental methods within the field of surface- and nanosciences. Since one can, in principle, obtain topographic information and spectroscopic data with atomic resolution at the same time, SPM techniques are also an invaluable tool within the relatively new field of low-dimensional materials. However, when dealing with suspended 2D materials (e.g. graphene, MoS_2), interpretation of the measured data is complicated, since the tip sample interaction is also changing the topography of the membrane. In this talk, I will show recent results of a novel type of Dual-Probe AFM/STM measurement, where the two probes approach a suspended thin membrane
from opposite sides. Having the STM tip in tunneling distance to the membrane, we were able to investigate its dynamical response as a function of the position of the scanning force probe. This provides insight into the interaction of the tip and the membrane. Additionally, we investigated local deformations of 2D materials caused by the approaching STM tip, while performing AFM measurements on the same site. Furthermore, operating the device in STM/STM mode, we explore electrical properties of suspended membranes and perform transport measurements at arbitrarily close distances of the two probes.

References

[1] Eder et.al, Nano Lett. 13(2013), 1934-1940
[2] Elibol et.al., Sci. Rep. 6(2016), 28485

Figures

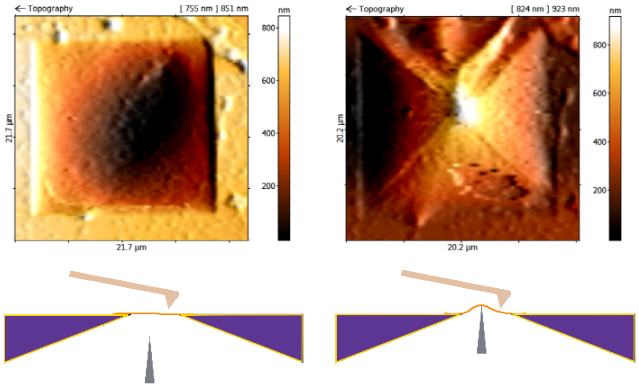

Figure 1: Static deformation of Membrane after STM approach

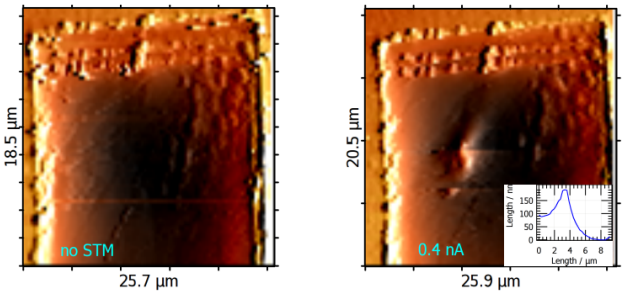

Figure 2: Local deformation caused by scanning tunneling tip during a scan