Novel configurations for Photo-Induced Microscopy

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We present an instrument for examining samples of Gr/Cu with the possibility of using mechanical and infrared measurement methods in parallel. We have upgraded the existing A.P.E. Research instrument (AFM-A100) to include the ability to apply a heterogeneous configuration to reveal the chemical properties of the surface of interest. We perform a generalized Photo-Induced Microscopy (PiFM) heterodyne configuration by introducing a novel schemes: harmonic heterodyne detection and sequential heterodyne detection. For this reason, we have designed an experimental apparatus to obtain generalized heterodyne configurations for PiFM and semicondact mode AFM. In past we compared study of the apparent barrier height distribution and surface potential of the sample and nanoparticles of semiconductors. We have implemented the experimental setup which was build based on ambient Scanning Tunneling Microscope (STM) and Kelvin Probe Force Microscope (KPFM) by A.P.E. Research. Photo-Induced Force Microscopy uses the detection of a mechanical heterodyne signal generated by the mechanical resonance oscillations of the cantilever and the photoinduced force induced by the interaction of light with matter. The aim of the job is to explore the possibility of using light sources with a moderate pulse repetition rate to perform PiFM measurements. More in detail, to overcome the diffraction limit of infrared microscopy, we use mechanical modulation mixed with light by atomic force microscopy (AFM) (heterodyne configurations) in which a signal frequency is created by combining or mixing two different frequencies. The heterodyne configurations for PiFM open up new possibilities for chemical mapping and broadband spectroscopy with a spatial resolution of less than λ/2. They are suitable for a wide range of heterogeneous materials in various fields, from structured polymer films to polaritonic boron nitride materials and isolated bacterial cell walls. This project is supported by MSCA under Horizon 2020 ULTIMATE (Grant Agreement No. 813036 - ETN).

References

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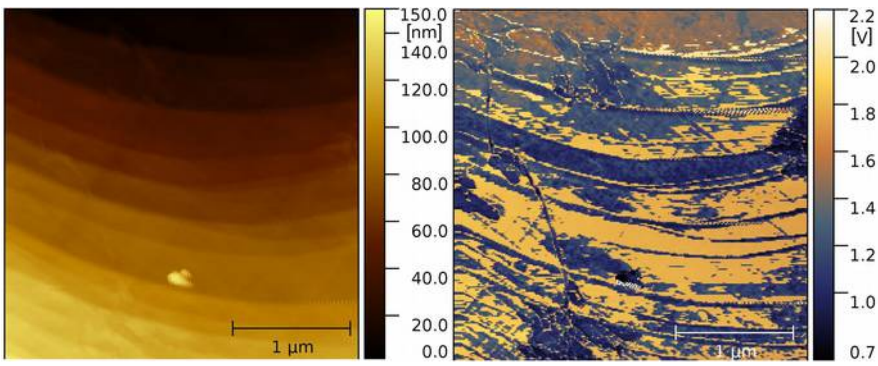

Figure 1: AFM (non contact) Topography and Phase of Gr/Cu. Topography (left) showes steps of about 20 [nm] in height. Phase (right) show a contrast due to different properties of the Graphene top layer.