A Comparison Between Tapping- and Constant-Excitation-Mode in the Dynamic Force Microscopy

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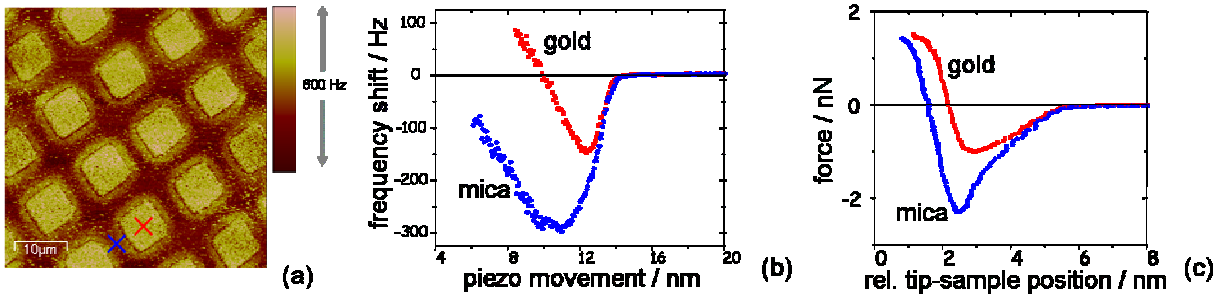
Dynamic modes are often used to enhance the resolution of an atomic force microscope. The “tapping”-mode is a well-known and established mode in air or liquids where the cantilever is oscillated with a fixed frequency near its resonance. Another possibility is to use the specific feature of a self-driven cantilever. This so-called frequency modulation (FM) mode was originally introduced for applications in vacuum but can also be applied in air and liquids [1,2].

We use a self-oscillating mode with a constant excitation amplitude for our measurements in air. In order to show possible advantages of this so-called Constant-Excitation (CE) mode we analysed and compared its results with measurements obtained in the conventional "tapping"-mode on various samples.

The most important advantage of the CE-mode is the analysis of the tip-sample interaction forces [3]. The possibility of perform dynamic force spectroscopy without instabilities or hysteresis allows a complete reconstruction of the tip-sample interaction force. Dynamic force spectroscopy measurements were carried out on various samples to show the influence of the material properties on the measured frequency shift.

Figure (a) shows the frequency shift image of gold islands (bright areas) on mica (dark areas). The force spectroscopy curves in (b) were taken at the marked positions. The different material properties of gold and mica can be clearly observed in the calculated tip-sample forces (c).



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