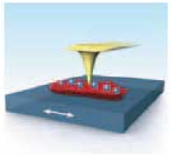


Visualize Molecules and Measure Mass:

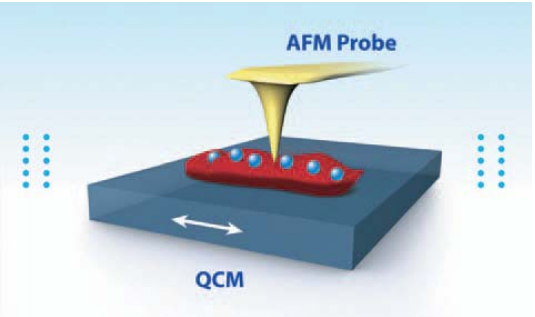
Combination of AFM and QCM-D

Revolutionary new step: QCM-D combined with AFM

QCM-D – what is it?

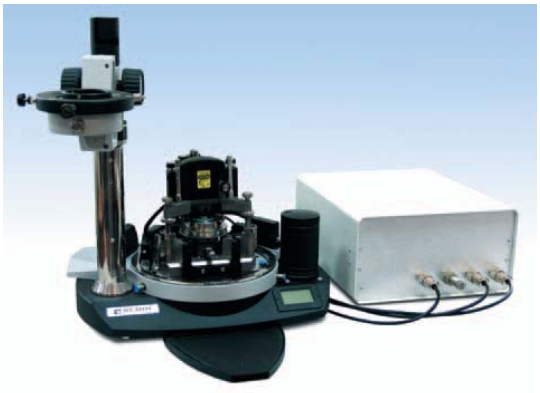
A simple, cost effective, high sensitive technique, Quartz Crystal Microbalance with Dissipation Monitoring (QCM-D) provides in situ, real-time characterization of the interactions of different polymeric and biomaterials at variety of interfaces. This method provides a wide detection range: from single bacteria or thin films to much larger masses deposited on the surface.

AFM + QCM-D. Operation principle

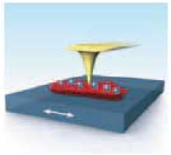


The heart of a QCM instrument is a thin AT-cut quartz crystal with an electrode on each side. The lateral oscillation of the quartz is excited by AC voltage, applied to the electrodes. The mass changes correspond to the resonance frequency variations. Viscoelastic properties affect Q-factor, which is obtained by direct impedance measurement.

AFM and QCM-D: enhanced possibilities in single platform



A specific design of a new and unique device incorporates the QCM into hermetic cell of the AFM. The integrated system is capable to carry out simultaneous monitoring of the surface structure changes (nanometer scale) and corresponding changes in the integral adsorbed mass (down to 0.3 ng).
Thus the researcher gets more data for comprehensive interpretation from a single platform.



Visualize Molecules and Measure Mass:

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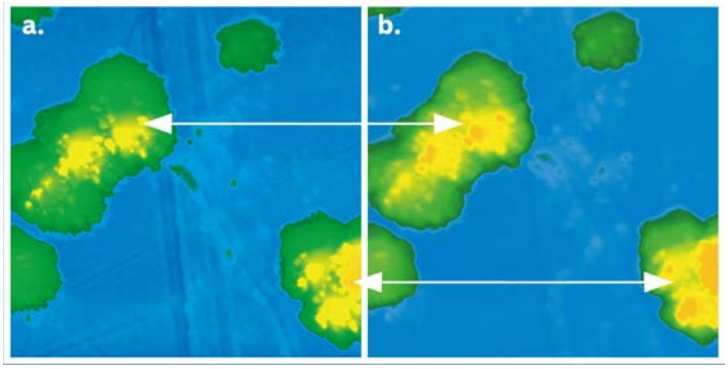
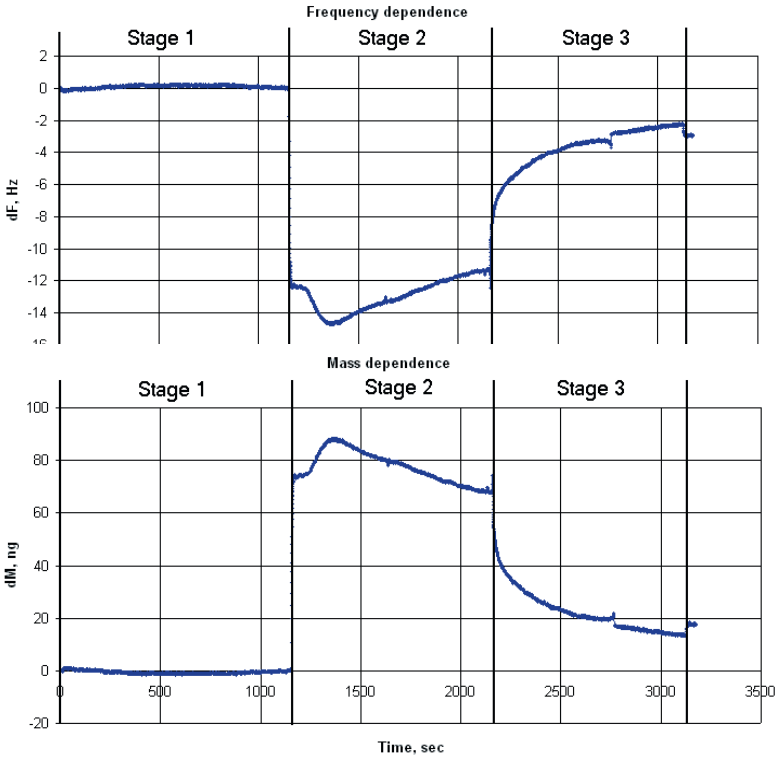
AFM + QCM-D: Why?

Thanks to the new NT-MDT pioneering instrument the range of possible functions of QCM-D is substantially enlarged due to whole arsenal of AFM techniques. Modular design of the QCM-D provides easy integration with the NTEGRA or SOLVER instrument platforms. So it is possible to assemble a system that meets cutting edge requirements for the following applications:

- analysis of sensor materials
- research in self-assembly layers and molecules, etc.
- biological research (DNA and RNA hybridization studies, immunological sensors)
- research in viscoelastic properties of thin films (e.g. polymer films)
- study of tribology
- research in organic chemistry (Self Assembled Monolayers, protein adsorption, etc)
- and others.



AFM image of HfO_2 clusters coated by the bromocresol purple (BCP) layer
a) Topography on the initial stage
b) Topography after ammonia absorption.
Due to sorption by BCP the mass of surface structure increased. It is confirmed by decreasing of quartz resonator oscillation frequency.



For the detailed description of the modeling experiment, please, visit NT-MDT Co. web-page.

The experiment was carried out by Dr. Sevastyanov V.G., Popov V.S., and Shelaev A.V.