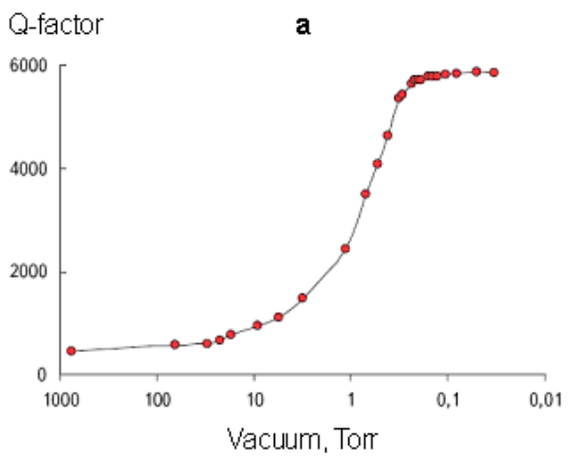
Measuring in vacuum and controlled atmosphere

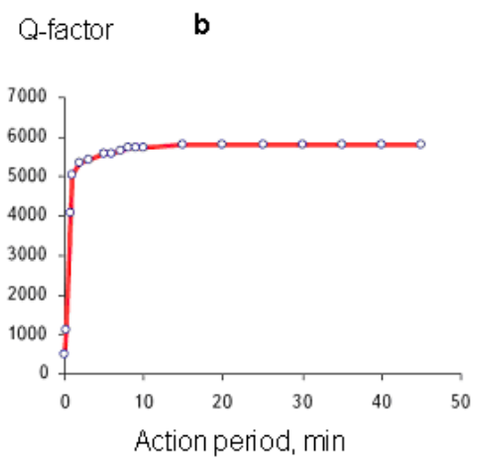
Vacuum allows raising the Q-factor of cantilever oscillations, which, in its turn, substantially raises the sensitivity o light magnetic forces measurements between the probe and the sample.

INTRODUCTION

The Q-factor of the cantilever in vacuum increases, thus gaining the sensitivity, reliability and accuracy of "probe-sample" light forces measurements. At that, the change from atmosphere pressure to 10^{-2} Torr vacuum provides the tenfold gain of Q-factor. By further vacuum pumping, Q-factor reaches its plateau and changes insignificantly. The sensitivity gain is especially important for the light forces measuring, for example extremely sensitive magnetic measuring, Kelvin Probe Microscopy and Scanning Capacitive Microscopy.



Q-factor reaches its plateau at the value of 10^{-1} Torr. Higher vacuum does not change Q-factor substantially.



Vacuum providing tenfold increase of Q-factor is reached in 1 minute after the operating starts.

High and ultra high vacuum systems provide the proper purity of processes. Owing to the high vacuum (up to 10^{-6} torr) conditions, there is no water on the sample's surface and in the probe-sample environment so there are no capillary forces between the probe and the sample, thus raises the force measurement accuracy that is useful for e.g. real adhesive effects study. Moreover, owing to the high vacuum one can carry out investigations in very low temperatures without "hoarfrost" on the samples' surface. The thermal variations device "Cold finger" in SOLVER HV-MFM provides cooling down to 110 K (using liquid N_2) and heating up to 420 K.

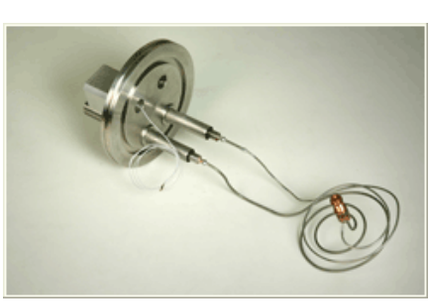
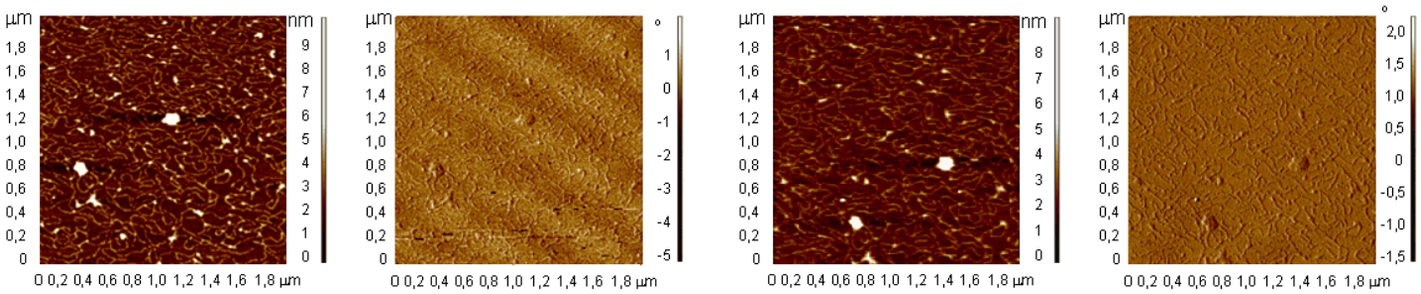


Fig.1 «Cold finger»

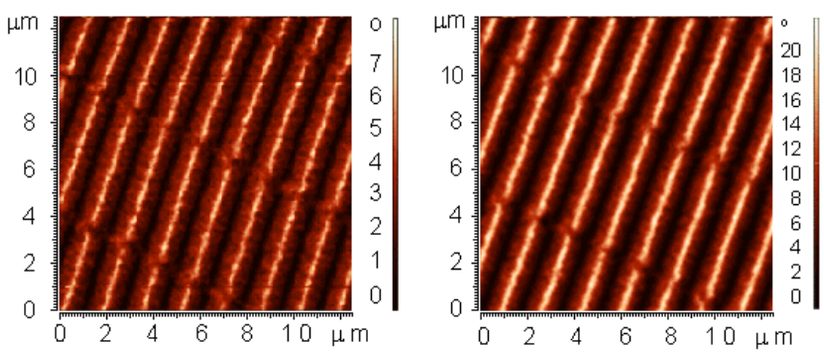
Fig. 2 High vacuum system SOLVER HV-MFM (10^{-8} Torr)

TOPOGRAPHY AND PHASE IMAGES OF DNA



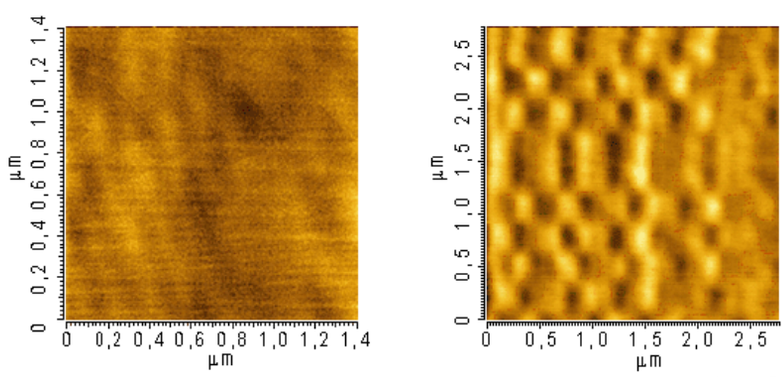
1) In air *2) In vacuum*

MFM IMAGES OF LOW-DENSITY HDD



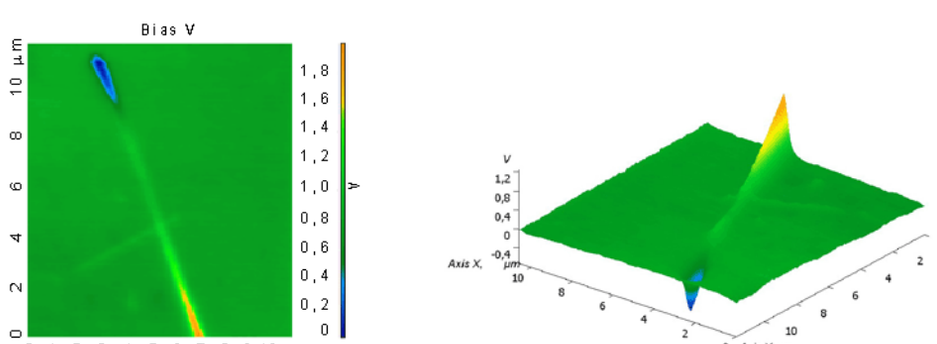
1) In air *2) In vacuum*

MFM IMAGES OF HDD OF HIGH DENSITY



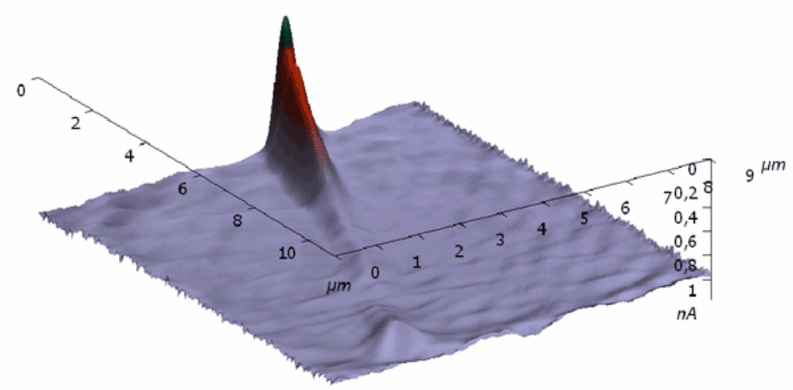
80 Gb HDD magnetization can be visualized in phase imaging mode in vacuum (5x10^{-7} Torr, right), while in air nothing is seen (left).

KELVIN PROBE FORCE MICROSCOPY IMAGING MODE IN VACUUM (5x10^{-7} Torr) AT 113 K

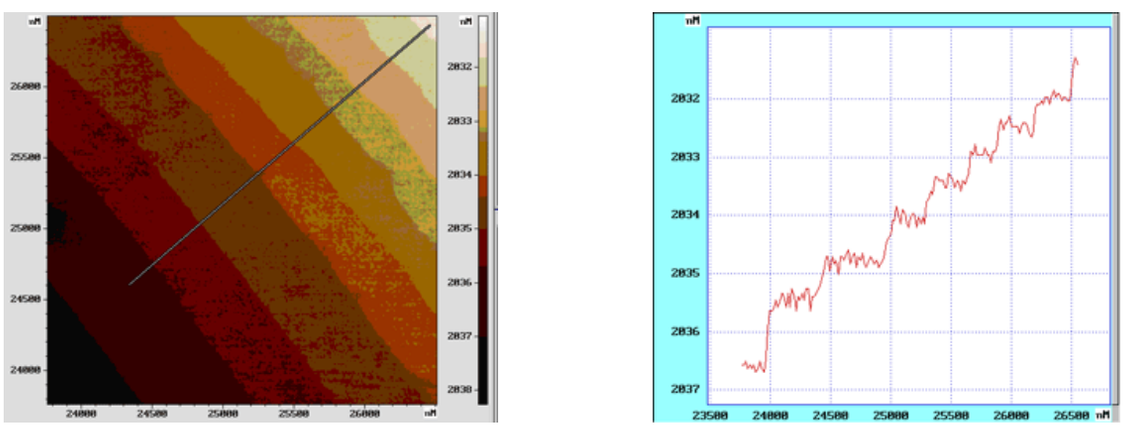


Kelvin Probe Force Microscopy imaging surface of unalloyed GaAs pre-charged by the lithography treatment. It shows the distinct differences in surface potential along the line.

SCANNING CAPACITANCE FORCE MICROSCOPY IN VACUUM (5x10^{-7} Torr) AT 113 K



Surface of unalloyed GaAs pre-charged by the lithography treatment.



Graduated surface of basic sapphire surface (c-plane), and its section by the given plane.
Graduated surface is obtained by annealing the sample at the 1350 °C.