The use of a optically trapped microprobe for scanning of surface details

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INTRODUCTION

The probe is trapped by focused laser beam (so called optical tweezers) and the deviations of the probe from its equilibrium position are detected using two-photon fluorescence (TPF) excited by the trapping beam and emitted by the properly dyed probe (polymer microsphere). The optically trapped probe represents an analogue to the cantilever of Atomic Force Microscope (AFM) and therefore this method is sometimes called Photonic Force Microscope. The unique feature of the optical trapping is the possibility to confine a probe inside transparent objects (e.g. living cells) or behind transparent obstacles (e.g. coverslip). Therefore, there is no need for mechanical contact between the probe (trapped microparticle) and its holder (laser beam). We compare here results obtained by two methods of surface profile scanning-contact mode and tapping mode.

DETAIL OF SAMPLE



POSITION SENSING

Nd:YAG laser: DPY 321 II, max output 1 W, wavelength | =1064 nm, (Adlas),



0.2

We demonstrated two simple methods of local probe microscopy with optically trapped probe which provide resolution in the order of tens of nanometers and which are useful for the study of surface profile inside transparent objects. The vertical sensitivity of contact mode and tapping mode methods was determined to 25 nm. Good coincidence between both methods is found in the lateral direction (groove width) and axial direction (groove depth). Worse coincidence is found in the details on the surface because the TPF position sensing detects not only the vertical displacement of the probe, but also lateral probe displacement with respect to the intensity maximum. Complete 3D position sensing will improve the accuracy of both methods.

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