

# Polymers & Thin organic films

## INVESTIGATIONS OF THE ELECTRIC PROPERTIES OF THE THIN ORGANIC FILMS

A.M. Alexeev, I.V. Myagkov, E.A. Mazurina (State Lukin Institute for Physical Problems, NT-MDT, Moscow)

Molecules of some materials have dipole moment. As a result thin organized films (Langmuir-Blodgett (LB) films, self assembled films etc.) of such polar materials have surface potential. The NT-MDT SPMs have different electric methods that enable to investigate electric properties of the film surface. Fig.1 presents the Scanning Kelvin Probe Microscopy (SKPM) results of the investigation of the LB film, which consists of blend of two components with different surface potential. The sample is the monolayer of p-octadecylcarboxyazobenzene-p'-sulphonamide and copolymer octafluoroamilmacrylate and metacrylic acid deposited on silicon surface by Langmuir method. The topography (Fig.1a) and the surface potential

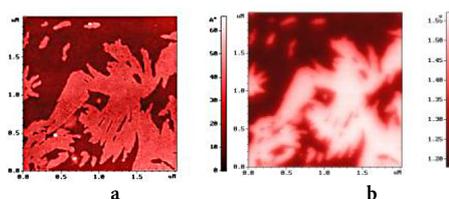


Fig.1. Topography (a) and surface potential distribution (b) of the two-component LB-film.

image (Fig.1b) were obtained simultaneously. The dark areas on Fig.1a correspond to the polymer. The difference in width between two components is about 1.5nm. The Fig.1b shows the distribution of the surface potential for same area. The areas with different potential are clear seen on SKPM image. The potential difference between components is about 0.35V. Macroscopic measurements on the water for pure materials give the potential difference

1.75V. The mix of the both components that clear seen on Fig.1a can explain this reducing.

The electrostatic force microscopy (EFM) allows detecting the electric fields distribution nearby sample surface. Topography (Fig.2a) and electric fields map (Fig.2b) show differences in the electric field for considered sample. The second pass height is 20nm.

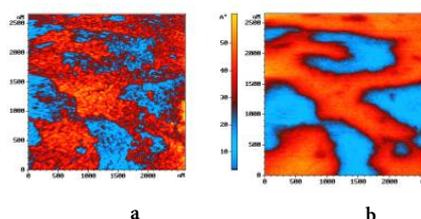


Fig.2. Topography (a) and electric field distribution (b) of the two-component LB-film.

The ordered structures of polar materials are perspective data storage media [1]. The SKPM is useful tool for determination of the surface potential of such structures. Fig.3 demonstrates topography (a) and surface potential (b) of self assembled monolayer of azobenzene containing thiols. The regions with higher potential (round spots on Fig.3b) are dodecanethiol (A). Surrounding monolayer is 4-trifluoromethyl-4'-(10-mercapto-decyloxy)azobenzene (B). The SKPM contrast is provided by strong dipole moment of the molecules of B whereas the dipole moment of A is very low. Absolutely difference between topography and potential image is provided by approximately equal length of molecules of both materials.

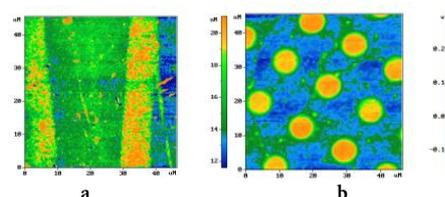


Fig.3. Topography (a) and surface potential distribution (b) of azobenzene self-assembled film.

### References

1. B. Stiller, P. Karageorgiev, et al., Scanning Kelvin microscopy as a tool for visualization of optically induced molecular switching in azobenzene self assembling films, Surf. Interface Anal. 30, 549-551, 2000.

### Acknowledgments

The authors thank Dr. P. Karageorgiev and Dr. B. Stiller (University of Potsdam, Germany) for sample of azobenzene self-assembled film.

### CONTACT DETAILS

NT-MDT Spectrum Instruments  
Proezd 4922, 4/3, Zelenograd, Moscow 124460, Russia  
E-mail: info@ntmdt-si.com  
Tel: +7-499-110-2050