Final report for short visit grant to Padova in 15.-29. May 2005 by Tanel Tätte

Micromolding of sol-gel materials by microstructured PDMS molds

The purpose of the visit was to prepare optically transparent oxide AFM cantilevers in co-operation with Dr. Marco Natali and Prof. Giampaolo Mistura at Dipartimento di Fisica "Galileo Galiei", University of Padova. All objectives set for this visit were fully achieved. It was demonstrated that the greatest drawback on preparing straight oxide cantilevers (mechanical stresses caused deformations) could be passed by using sol-gel micromolding. Suitable precursor were smeared to straight micron deep cavities on polydimethylsiloxane (PDMS) mold surface and left for hydrolysing over night. Solidification of smeared material was caused due to the reaction of precursor by water absorbed in to the mold body. For removing cantilevers from the mold surface, adhesion of formed oxide structures to the surface of PDMS were demonstrated as most promising. The straightness of obtained linear oxide structures can be explained by low mechanical stresses in their material.

As a result of joint experiments, AFM and AFM/SNOM cantilevers suitable for nanotribological studies were prepared (Fig.1). We suppose that choice to vary oxides as sensor materials can sufficiently widen applications of AFM technique in nanometre level friction studies. In our further co-operation we plan to study that phenomena using sensor materials like TiO_2, SnO_2, ZrO_2, HfO_2 etc. Moreover, as all of those materials are transparent oxides, possible photon effects to the friction at nanoscale can be controlled with their help.

Quite surprisingly it was found that smearing of highly viscous metaloxanes is also promising process for coating different flat surfaces by oxide structures. Further developments of this technique will be also the subject of our future cooperation. As characteristic features of smearing process are low cost and applicability over large scale than potential usage of that novel coating technique can be forming highly controllable structured surfaces for nanotribological research, also production of solar cells and gas sensors etc.

Results obtained during the visit will be published as a joint paper. I acknowledge the *NATRIBO* program of the European Science Foundation for the support of the visit.

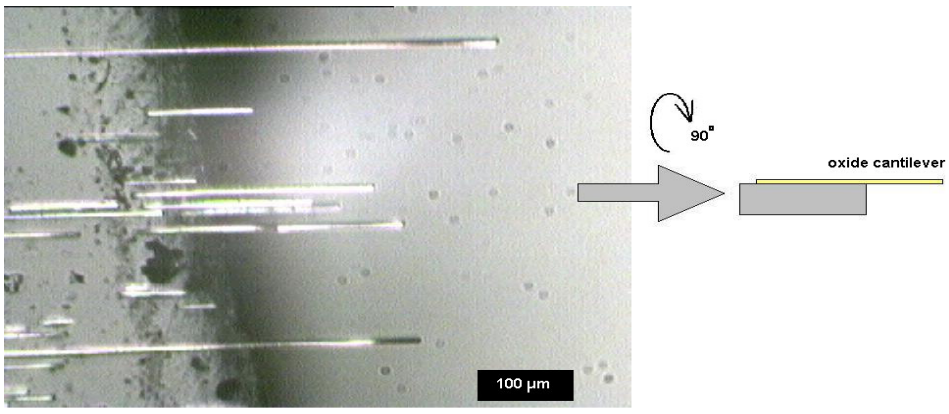

Fig.1 Novel SnO_2 sol-gel micro structures on PDMS surface