*Poster*

# VARIABLE TEMPERATURE SCANNING FORCE MICROSCOPE FOR THE APPLICATION TO NANOSCALE POLYMER CHARACTERIZATION


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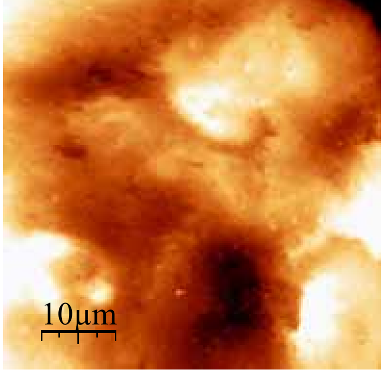
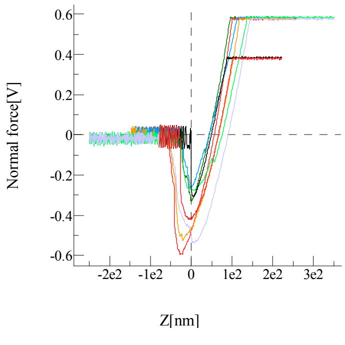
Polymers are among the most studied compounds in modern material science due to its versatility, its easy manufacturing and its low-cost production. The range of its applications spans from sophisticated electro-optic devices, including solar cells, in the case of conducting polymers to tribological and sealing applications in the case of elastomers and rubber-like materials. With the development of Scanning Force Microscopy (SFM) it has become possible to study the surface structure as well as electrical, mechanical and tribological properties on a nanometer scale.

Polymers show a very rich variety of phenomena as a function of temperature –for example melting, glass transitions and phase separation- which fundamentally determine their behavior. Correspondingly, different groups are focusing their efforts to study polymer samples with variable temperature Scanning Force Microscope. In the present work, we describe such a system implemented using Peltier elements allowing fast and flexible adjustment of sample temperature. For a variable temperature SFM two parameters have to be optimized: the maximum available temperature range and the drift behavior due to temperature variation. We will discuss the overall performance of our system with respect to these parameters and compare the experimental results with a simple model to understand the limitations of variable temperature SFM.

Finally, first measurements on an elastomer sample (HNBR) will be presented to show the capabilities of variable temperature SFM on this kind of samples. In addition to topographical images, local force spectroscopy data has been acquired to determine on a nanometer scale the variation of adhesion forces as well as the local elasticity of an elastomer as a function of sample temperature.




Left: Topography image of HNBR sample (size 50 µm$^2$, $\Delta_{scale}$ 1.3 µm). Right: Force *vs.* distance curves at different temperatures 20, 37, 47 and 57 ºC with adhesion values of 45, 48, 54 and 55 nN respectively.