Advances local techniques to characterize polymer dynamics on nanometer scales.

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Collaborations: Solvay research laboratory

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The goal of this thesis project is to develop the experimentation and methods to study the polymer dynamics at nanometers scales in thin films a few nanometer thick. The films will made either of pure polymers or of a mixture of nano particules and polymers in order to understand the changes induced by the presence of nano-particles on the local dynamics and mechanical properties. These measurements are useful for giving more insight into the widely studied problem of the polymer dynamics, which is strongly modified in presence of interfaces.

Collaborations: A better knowledge of these properties is important not only from a fundamental point of view but also for the applications of polymers in high performance materials, such as those employed for example to reduce either the weight of the structures or the friction coefficients.
For this reason although this research investigates mainly fundamental questions, the project will be developed in collaboration with the research laboratory of the Solvay enterprise which is interested to these questions for improving the properties of their products.

Experimental techniques: The measurements will be performed using updated techniques such as local dielectric measurements and SNOM (scanning near-field optical microscope). The preparation of the sample will be done in clean rooms and the surfaces will be characterized using STM (scanning electron microscopy) and AFM (atomic force microscopy). the construction of specific devices will be probably necessary. The data analysis and theoretical interpretation will be done in collaboration with the Solvay team.

No specific knowledge of the subject and instrumentation is required but we look for candidates with a strong interest in experimental physics and in the use and the development of complex instrumentation.