

## **Mesoscale and nanoscale investigations of friction properties of low dimensional compounds using Atomic and Lateral Force Microscopy: influence of velocity on tip motion and energy losses**

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Recent developments of atomic force microscope [1] provided a powerful tool for the atomic level friction mechanisms. However, one of the major problems encountered using such a technique is the quantification of the normal and lateral forces exerted by the surface on the tip. Such data are of first interest in order to characterize quantitatively the intrinsic tribological properties of material surfaces (clean or covered by adsorbed layers).

In this paper an original quantization method developed in our laboratory and presented elsewhere [2] is used to study quantitatively the friction properties of several lamellar compounds. The experiments are performed at two different scan velocities:  $V=30 \text{ nm.s}^{-1}$  (scanning area of  $5 \text{ nm} \times 5 \text{ nm}$ ) and  $V=30 \text{ }\mu\text{m.s}^{-1}$  (scanning area of  $5 \text{ }\mu\text{m} \times 5 \text{ }\mu\text{m}$ ).

In the low speed regime, the contrasts in the deflection and lateral force images are quantitatively interpreted in terms of “stick-slip” type motion of the tip, the tip sticking in the potential minima of the surface. The numerical resolution of the “stick-slip equation proposed by Zwörner [3] using our experimental parameters allowed us to obtain simulated images in good agreement with experimental ones.

In the high speed regime, experiments pointed out a continuous motion of the tip in agreement with theoretical predictions of Zwörner et al.[3]. Quantitative interpretation of the deflection and lateral force images allowed us to extract the  $F_l/F_n$  curves and to characterize the mesoscale friction coefficient. The results are readily different from those obtained at macro and atomic scale pointing out that energy dissipation processes are probably different for each scale.

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