# MECHANICAL PROPERTIES OF ARACHIDIC ACID LANGMUIR-BLODGETT FILMS STUDIED WITH AFM AND LATERAL FORCE MICROSCOPY (LFM)

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Langmuir-Blodgett films have been a matter of extensive study during the last decades. The capability to control the lateral pressure of the extracted films and the area per molecule are of great interest in efforts in biology, chemistry and physics. Moreover, this technique lets us to study in detail the different organizations and phase transitions that take place as the lateral pressure (compactness) increases. In this direction, fatty acid films have been a reference in this kind of studies because of the symmetry of these molecules and their biological relevance. Arachidic acid Langmuir-Blodgett films have been studied in the past and there are some results about the different phase transitions they undertake and the structural organization of the molecules in each of these phases[1].
Atomic Force Microscopy has proved to be a powerful technique to study the topography of Langmuir-Blodgett films[2,3] and also the topography of other “soft” organic layers as phospholipid bilayers. Because of the versatility of this technique, it is possible to image the samples at variable temperature[4] and also in different environments.
The Lateral Force Microscopy is a technique derived from AFM that lets us to test the tribological properties of surfaces at a nanometric level. It has been widely used to study the wear and frictional properties of hard materials and engineering coatings as diamond-like carbon films[5]. In the field of organic monolayers, we have previously used this technique to study Langmuir-Blodgett films of a thiomacrocyclic compound[6]. It has been proved that the frictional response of the monolayer depends on the extraction pressure, so the pressure withstand by the monolayer before breaking increases with the extraction pressure.
In the present study, we present preliminary friction and topographic experiments performed on arachidic acid monolayers. The monolayers have been extracted at different pressures, namely 1, 15 and 40 mN/m, going from a poorly compressed liquid phase to a fully compressed solid phase.
Wear experiments have been performed on these monolayers in order to evaluate in-situ the way they erode as the vertical force exerted by the tip increases (fig. 1). It is possible to relate the friction signal and the corresponding topographic signal because they are recorded simultaneously. In addition, it has also been studied the response of the monolayer as a function of the linear speed of the tip. Future experiments will consist on friction force vs. vertical force curves obtained on the arachidic acid monolayer at different pressures in order to assess the frictional response of the layer because of an increasing vertical force.

**References:**

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**Figures:**

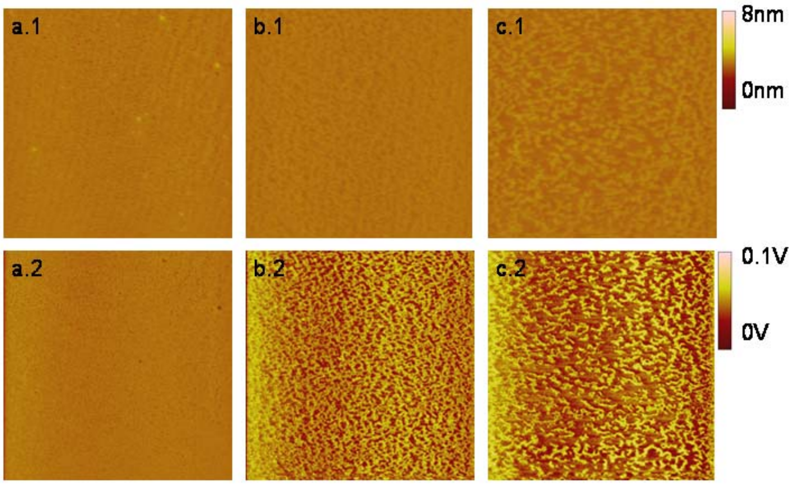


*Fig. 1. Wear experiment performed on an arachidic acid Langmuir-Blodgett monolayer extracted at 1mN/m. The top row of images corresponds with the topographic signal while the lower row corresponds with the lateral signal. The three sets of signals were recorded at different vertical force. a) minimum contact force; b) 26.7 nN; c) 45.9 nN. Data were obtained in contact mode.*