DIELECTRIC PROPERTIES OF MULTILAYERED MATERIALS BY ELECTROSTATIC FORCE MICROSCOPY

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Extraction of quantitative information from experimental measurements is a central piece of any SPM technique. This fact is even more relevant when we treat to establish different physical properties of nanostructures. A widely used technique is the Electrostatic Force Microscopy (EFM). Using a biased AFM tip, it is possible to measure different electrostatic properties of a sample. Different advances on the theoretical analysis of experimental EFM data have been recently carried out [1,2]. The basis of these tools is the calculation of the electrostatic force between a biased EFM tip and a sample, the primary method of calculation is the so called Generalized Image Charge Method (GICM) [1].

In this work we present an extension of this method to include multilayered dielectric materials. Each dielectric layer can be described using a scalar dielectric constant or, in a more general description of the system, it is possible to introduce certain kinds of anisotropy using a dielectric tensor with two different components, one corresponding to the direction perpendicular to the layer interfaces, and the other one corresponding to the perpendicular direction. The number of layers and their dielectric properties is arbitrary.

As an example of the application of this method, we analyse different cases of a material made of two different dielectric layers and a metallic grounded back-electrode. Showing how it could be possible to extract quantitative information from EFM measurements.

References:

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