Type of presentation: Invited

IT-14-IN-2450 Advances in quantitative and three-dimensional mapping of soft matter by bimodal force microscopy

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Force microscopy is considered the second most relevant advance in Materials Science since 1960. Despite the success of AFM, the technique currently faces limitations in terms of three-dimensional imaging, spatial resolution, quantitative measurements and data acquisition times. Atomic and molecular resolution imaging in air, liquid or ultrahigh vacuum is arguably the most striking feature of the instrument. However, high resolution imaging is a property that depends on both the sensitivity and resolution of the microscope and on the mechanical properties of the material under study. Molecular resolution images of soft matter are hard to achieve. In fact, no comparable high resolution images have been reported for very soft materials such as those with an effective elastic modulus below 10 MPa (isolated proteins, cells, some polymers). Similarly, it is hard to combine the exquisite force sensitivity of force spectroscopy with molecular resolution imaging. Simultaneous high spatial resolution and material properties mapping is still challenging. This presentation reviews some of the above limitations and some recent developments based on the bimodal operation of the AFM to address and overcome them.

Recent References

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E. T. Herruzo, H. Asakawa, T. Fukuma, R. Garcia, Nanoscale 5, 2678 (2013)
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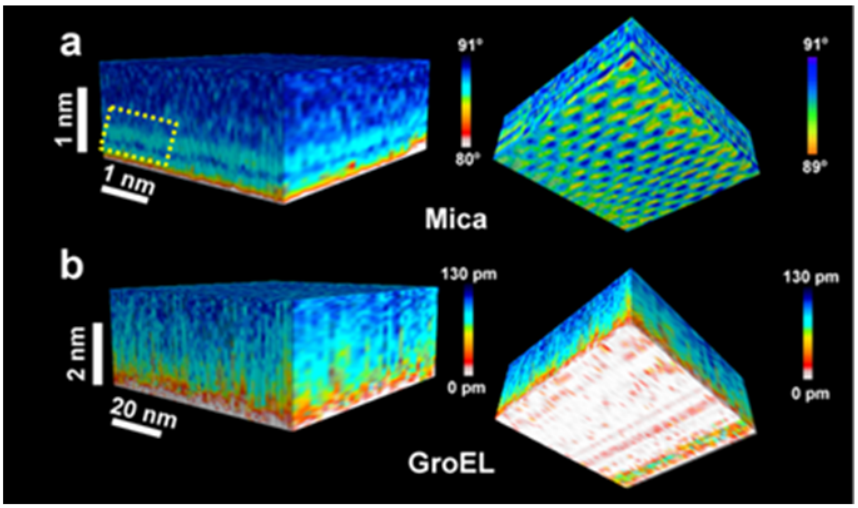

Fig. 1: Bimodal AFM 3D images of solid-water volumes. a, 3D map of a mica-water interface. The stripes are associated to the presence of hydration layers. b, 3D map of a GroEL patch-water interface. The side view shows a slightly rough landscape with variations of the amplitude of about 1 nm.