

P13 – Subsurface and multi-setpoint amplitude modulation atomic force microscopy on soft materials

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Amplitude modulated atomic force microscopy (AM-AFM), also known as tapping mode atomic force microscopy, has emerged as a standard method in polymer science allowing for non-destructive imaging of interfaces and structures of very soft or even liquid materials. We present a new operation and data analysis mode that extends AM-AFM to depth-resolved imaging of the top ~20 nm of soft specimens. It is based on pointwise measurement of amplitude and phase versus tip-sample distance (APD curves).^[1-4] These data contain information about the shape of the unperturbed surface and the tip-indentation depth into the specimen.^[5] Here we show how depth resolved cross sections and 3D images of the subsurface structure can be reconstructed from APD curves.^[6,7]

Furthermore, we present an approach where pointwise measurement of amplitude and phase as function of tip sample distance is used to reconstruct amplitude modulation atomic force microscopy (AM-AFM) images. From one single-pass measurement, images for almost any amplitude setpoint are reconstructed.

The presented methods overcome most limitations of AM-AFM and allow for a better and more quantitative interpretation of height and phase images. The materials studied include block copolymer microdomains, crystalline lamella in elastomeric polypropylene, surfaces of poly(3-hexylthiophene), supramolecular aggregates deposited on a substrate, and collagen fibrils.

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