High-resolution Imaging of Biomaterials by Frequency-Modulation Torsion Resonance Mode Atomic Force Microscopy
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Motivation

High resolution imaging of biomaterials in liquid is achieved by frequency modulation torsional resonance (FM-TR) mode atomic force microscopy (AFM). In comparison with the conventional flexural mode operated in liquid, either static or dynamic, TR mode has much better quality factor factor and hydrodynamic interactions can be effectively reduced. In addition, using frequency-modulation as the feedback, force sensitivity can be further improved. Therefore, a clear detection of contact point between the tip and sample as well as the high resolution imaging can be obtained regardless of the ion concentration of the buffer solution.

Experimental Setup

Clear Detection of the Contact Point

Images of Duplex DNA on a Mica Surface

High-resolution Imaging of Purple Membrane

High Q Factor and High Resonance Frequency

Small Lateral Forces on biomaterial surfaces

Conclusions

Torsional resonance of a soft cantilever has a high Q factor and high resonant frequency in air as well as in liquid.

FM-TR mode can provide a clear detection of the contact point between the tip and the sample.

In FM-TR mode, the measured height of the DNA molecule is close to its diameter determined by X-ray diffraction.

References

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