Optimizing atomic resolution of force microscopy in ambient conditions

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Ambient operation poses a challenge to atomic force microscopy because in contrast to operation in vacuumor liquid environments, the cantilever dynamics change dramatically from oscillating in air to oscillating in a hydration layer when probing the sample. We demonstrate atomic resolution by imaging of the KBr(001) surface in ambient conditions by frequency-modulation atomic force microscopy with a cantilever based on a quartz tuning fork (qPlus sensor) and analyze both long- and short-range contributions to the damping. The thickness of the hydration layer increases with relative humidity; thus varying humidity enables us to study the influence of the hydration layer thickness on cantilever damping. Starting with measurements of damping versus amplitude, we analyzed the signal and the noise characteristics at the atomic scale. We then determined the optimal amplitude which enabled us to acquire high-quality atomically resolved images.

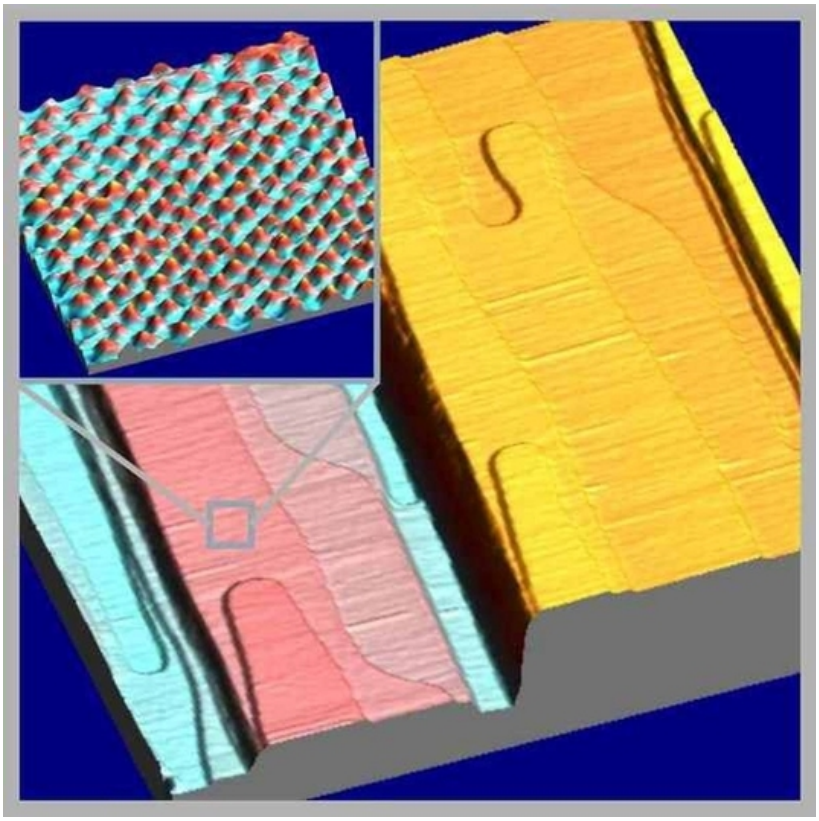

Figure 1: KBr(100) under ambient conditions. The inlay shows the atomic structure of the sample.

References

[1] D. S. Wastl, A. J. Weymouth and F. J. Giessibl, *PHY. REV. B* **87** (2013) 245415. DOI: 10.1103/PhysRevB.87.245415