Atomic force microscopy

Atomic force microscopy (AFM) involves a sharp tip, mounted on a flexible lever (“cantilever”) that is scanned over the sample surface as a miniature blind-man’s stick. The force between the tip and the sample is typically detected via a laser beam deflected from the cantilever. The line-by-line surface contours can be merged to create a 3D image of the sample surface. AFM can be performed in air, liquid (as shown in the image on the left), or in ultra-high vacuum conditions.

This poster shows some selected applications, based on measurements carried out on the LCN

AFM user facilities at the LCN: Several of the atomic force microscopes at the LCN are accessible for all members of UCL and Imperial College, provided that they have followed one of our AFM trainings. Shown here are our Bruker-AXS (formerly Veeco) Dimension 3100 (left) and MultiMode (centre), as well as one of our JPK Nanowizards (right). Apart from the instrumentation, our key strength lies in the vast AFM expertise that is available in the LCN.

Biomolecules and biomolecular complexes

- Atomic-resolution imaging of surfaces in physiological buffer solutions – mica
- 2D crystal of membrane proteins (Bacteriorhodopsin), in buffer solution
- Imaging intact nuclear pore complexes and probing the stiffness of their central channel, in buffer solution
- DNA structure (top) and electrostatic surface potential (bottom) measured by Kelvin Probe Force Microscopy (in air)

Probing elasticity of living cells

On a combined AFM/confocal-microscopy set-up, fluorescently marked cells can be imaged and probed to determine their viscoelastic properties

Organic semiconductors: structure & conductivity

Rubrene grows beads at step edges: (a) 1 hour after cleaning, (b) 1 day after cleaning, (c) 7 days after cleaning, (d) 11 months after cleaning. The colour scale is 10, 13, 45 and 150 nm respectively

Rubrene surface structure and conductivity (2 months after cleaning): a) Topography (contact mode – scale 100nm), b) Current measured by Conductive-AFM, of the same area (scale 200nm). (c) and (d) show topography and a C-AFM map, respectively, near a step edge highlighted in (e). (a) and (f) show topography and conduction profiles, respectively, of the indicated paths in (c) and (d)

Publications


Acknowledgements

- Academics leading the work shown here: Franco Cacialli, Guillaume Charras, Neil Cunton, Bart Hoogenboom
- AFM facility management: Richard Thongate, Guillaume Charras and Bart Hoogenboom
- Collaborators: At present there are about 70 regular users of the LCN AFM facilities (mostly from UCL and Imperial College)
- Contact details: Richard Thongate (r.thongate@ucl.ac.uk; 020 7679 0260) and Bart Hoogenboom (hoogenboom@ucl.ac.uk; 020769 0066, x20606)

LCN team

Nano-scale optical lithography on polymer surfaces

- EPSRC
- BBSRC
- The Royal Society
- Engineering and Physical Research Council
- Research Councils UK

More information: http://www.londonnano.com/research-and-facilities/facilities/afm-lab/afm-training (since 2008, we have trained >150 users on our microscopes)