

Advanced materials characterisation with atomic force microscopy

Atomic force microscopy (AFM) is a highly versatile tool for providing characterisation of materials and devices at the nanoscale. AFM is well known to provide topographical information such as roughness and morphology, but there are a number of different measurement modes that go beyond topography and provide a deeper understanding of materials and device properties. This talk will give a brief introduction to the wide variety of measurement modes available with AFM, including electrical modes such as Kelvin probe force microscopy (KPFM), piezoresponse force microscopy (PFM) as well as nanomechanical characterisation. Examples of how these measurement modes can be applied will also be discussed. These include:

- Investigation of 2D materials, where combined correlative imaging, by seamlessly switching between techniques like conductive AFM (C-AFM) and Kelvin probe force microscopy (KPFM), allow for fast same area mapping of local electronic heterogeneities and defects down to the atomic level.
- Measurements of low-dimensional optoelectronic materials, which enables simultaneous assessment of morphology, charge transport, and photonic response, crucial for understanding structure-property relationships.
- Characterization of nanoparticles where AFM has the ability to resolve size, shape, aggregation state, and local electronic behavior at the single-particle level.
- Nanofabricated device measurements, where high throughput with sub-nanometer precision is achieved in measuring critical dimensions and defects, while also evaluating local electrical and mechanical performance.