RESONANT DISTANCE SPECTROSCOPIC SCANNING PROBE MICROSCOPY

Tech ID: 34276 / UC Case 2026-031-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

State-of-the-art scanning probe microscopy (SPM) systems, including microwave impedance microscopy (MIM) and near-field scanning microscopy (NSOM), typically operate in a dynamic, non-contact “tapping” mode. Lock-in detection at the probe cantilever’s resonant mechanical oscillation frequency mitigates effects of drift and achieves high measurement sensitivity of local material characteristics. Electrical, mechanical, or other material properties can be measured down to the nanoscale. However, a full time-domain tip-sample response would yield a much richer data set. Unfortunately, existing methodologies require moving the entire scan head to sweep the tip-sample separation at rates far below the resonant frequency of the cantilever or tuning fork—yielding slow scan speeds and outputs vulnerable to drift, 1/f noise, and stray coupling.

To overcome these challenges, UC Berkeley researchers have leveraged high-speed data acquisition, wideband detection electronics, and modern real-time computing to acquire hyperspectral datasets at twice the mechanical resonant frequency of the probe. The invention captures up to hundreds of thousands of curves per second, without sacrificing scan speed, resolution, or stability. It can be straightforwardly integrated on most commercial SPM platforms, and for a wide range of resonantly driven probes, including cantilevers, quartz tuning forks, and qPlus sensor. Among other benefits, the technique enables novel post-processing capabilities, including retrospective enhancement of spatial resolution.

SUGGESTED USES

» Scanning probe microsopy (SPM), e.g., enhanced data sets for MIM, SNOM, and others

» Post-processing SPM data for increased spatial resolution

ADVANTAGES

» Measures full time-domain tip-sample interactions in dynamic, tapping mode

» High-throughput, hyperspectral data for nanoscale materials properties

» Integrates on existing SPM platforms and most resonantly driven probes

RELATED MATERIALS

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OTHER INFORMATION

CATEGORIZED AS

» **Optics and Photonics**
» All Optics and Photonics
» **Imaging**
» Other
» **Materials & Chemicals**
» Biological
» Ceramics
» Composites
» Electronics Packaging
» Nanomaterials
» Other
» Polymers
» Storage
» Thin Films
» **Nanotechnology**
» Electronics
» Materials
» Other
» Tools and Devices
» **Research Tools**

» Other

» **Semiconductors**

» Materials

» Other

» Testing

» **Sensors & Instrumentation**

» Other

» Physical Measurement

RELATED CASES

2026-031-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Nonlinear Microwave Impedance Microscopy

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