SSL Common Terms and Abbreviations

AFM—Atomic force microscopy; atomic force microscope

Aliasing—Electronic image error due to differences in resolution between surface features and the pixels used to represent them.

Bias—Electrical potential applied to a tip or sample which causes electron flow to ensue from one to the other (STM and EFM only)

Calibration—Measurement of known features to ensure accuracy of SPM images

Cantilever—Flexible portion of probe extending from the substrate to which the tip is attached

Cantilever tune—Process of finding a cantilever's natural resonant frequency by exciting the cantilever through a range of frequencies until maximum amplitude is obtained (the frequency at which maximum amplitude is obtained is the resonant frequency)

Coercivity—intensity of the applied magnetic field required to reduce the magnetization of a material to zero *after* the magnetization of the sample has been driven to saturation; measure (in oersted or A/m) of the resistance of a ferromagnetic material to demagnetization

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DSP—Digital signal processor; computer processor used to control SPM feedback loop

Drive amplitude—AC voltage applied to the piezo to oscillate a tip in TappingMode

Drive frequency—Frequency of the AC signal used to oscillate a tip in TappingMode

ECAFM—Electrochemical atomic force microscopy

EFM—Electric force microscope; SPM mode used to image electric forces on samples

Engagement—Process of bringing a probe tip and sample together in a controlled manner such that useful information about the surface is obtained without damaging either the tip or the sample

Error—Difference between actual tip-sample force measured at the detector and the setpoint force

False engagement—Condition due to surface effects or insufficient setpoint (too low during contact AFM; too high during TappingMode) in which the feedback controller attempts imaging a sample that is not engaged with the tip

Feedback—Process of self-correction between probe's actual, real-time height/surface force and its intended height/surface force based upon the probe's signal

Fluid cell—Accessory used for imaging materials in fluid, consisting of a specialized tipholder and O-ring

Force modulation—SPM mode used to image visco-elastic properties of materials

Integral gain—Amount of correction applied in response to the average error between setpoint force and actual force measured by the detector

LFM—Lateral force microscopy; frictional measurements of surfaces based upon a tip's lateral and torsional responses

LiftMode—Two-part, proprietary method of imaging surfaces consisting of a surface scan to obtain height data, followed by a second scan to extract other information about the surface (such as magnetic force or elasticity) while the tip traces the previous Z path at a constant lift height off the surface; the two images are subtracting from each other to yield an image uninfluenced by topography

LookAhead gain—Amount of correction applied in response to the error signal between setpoint force and actual force measured by the detector, based upon recorded information from the adjacent scan line.

MFM—Magnetic force microscopy

NanoScope—Trademark name applied to Bruker's SPM products

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Piezo----Material that expands or contracts based on an applied voltage; a piezoelectric actuator controls the AFM tip and/or stage movement in the x,y, and z directions with extreme precision

Probe—Integrated mechanical device used to image surfaces, including a substrate, cantilever and tip

Proportional gain—Correction applied in response to the error signal between setpoint force and actual force measured by the detector, in direct proportion to the error signal

RMS amplitude—Root mean square (RMS) signal measured at the detector (TappingMode only)

SPM—Scanning probe microscopy; scanning probe microscope; general term encompassing all types (modes) of microscopy that utilize a scanned micro-sharpened probe and feedback circuitry to image nanometric phenomena, including AFM, ECAFM, ECSTM, EFM, MFM, STM, etc.

STM—Scanning tunneling microscopy; scanning tunneling microscope

Sensitivity—Amount of movement produced by a scanner piezo for a given amount of voltage

Setpoint—Operator-selected force threshold between tip and sample used as the feedback control loop's target

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Spring constant—Amount of force required to bend a cantilever some given amount

TappingMode—Proprietary mode of SPM exclusive to Bruker that utilizes an oscillating probe to obtain nanometric images; advantages include minimal surface impacts, high resolution, and sensing of magnetic, electric and chemical forces

Tipholder—Removable appliance for mounting SPM probes; on MultiMode SPMs, the tipholder is installed within the head of the microscope, whereas on Dimension Series SPMs, the tipholder plugs onto the end of the scanner tube