Product Information

SURFACE IMAGING SYSTEMS

The PM Control

Scanning Surface Potential Microscopy (SSPM), Kelvin Probe Microscopy

The new PM Control made by S.I.S. extends the universal AFM-controller SCANControl C by the SSPM Mode. This Mode enables the local investigation of electronic properties of conducting and insulating surfaces.

This non contact method characterizes work function, surface potential, and charge distribution. Using the PM Control you can do SSPM measurements – similar to the well known Kelvin Probe technique – with your AFM/SPM, i.e. the S.I.S. ULTRAObjective.

Now you can measure topography and simultaneously analyze the properties of electronic devices, conducting polymers or insulators with nanometer resolution.

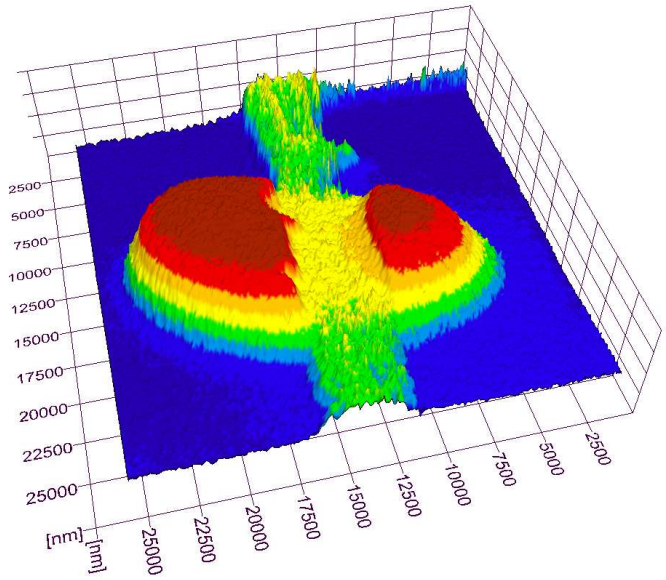

Fig. 2 Voltage and charge contrast measured with S.I.S.' PM Control module: Image of a conductor path made of gold on SiO_2. The conductor path is at contact voltage potential; next to it a potential peak is visible.
This peak is caused by charges which diffused through a defect into the insulating SiO_2 substrate.

Certainly, additional variations may be implemented with the flexible PM Control. I.e. the local capacitance between tip and sample surface can be measured by detection of the modulation at double AC frequency. Thus local variations of the capacitance or the dielectric constant can be investigated in high lateral resolution.

The PM Control is available as an upgrade for all SURFACE IMAGING SYSTEMS' instruments including the SCANControl C (i.e. ULTRAObjective, NANOStation II, PICOStation).

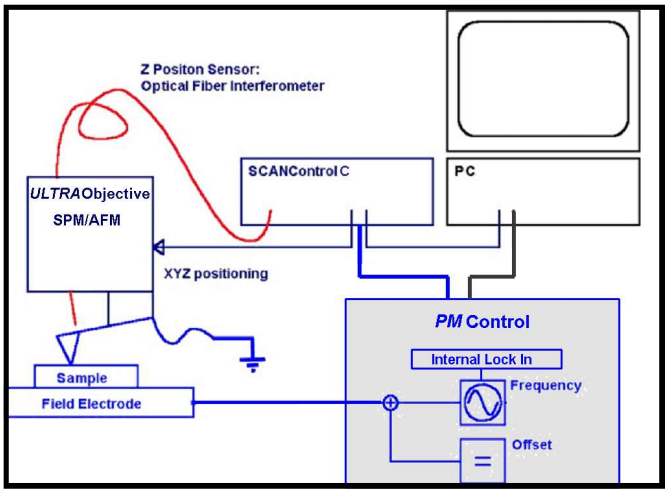

Fig. 1 The PM Control Module (schematic)

The set up of the atomic force microscope with SSPM Modus consists of the ULTRAObjective system including scanning head, amplitude detector (optical fiber interferometer), controller SCANControl C and computer. In addition, it includes the PM Control module, which contains - besides the frequency generator - a highly precise lock-in amplifier. The PM Control is connected to the sample – or in case of an insulating sample – to the sample holder (field electrode).
An AC voltage of some Volts amplitude and a frequency of some kHz are applied to the sample. The AFM/SPM is operated in Non-Contact mode.

Method

While the tip is moving in Non-Contact Mode in a short distance above the sample surface, the additional AC voltage creates a modulation of the tip's movement. The AC frequency is faster than the distance control (feedback) of the AFM. The modulation is measured by the PM Control and displayed simultaneously with the topography data.
Alternatively the DC component (offset) can be compensated during the scan. This will result in quantitative data of the surface potential.

Specifications of the PM Control:

Frequency range:	20 kHz– 1 MHz
Modulation:	first or higher harmonics
Digitalization:	16 bit in measurement range
Interface:	USB
Handling:	Software included in *SCAN*Panel

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