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U. Hartmann
VAN DER WAALS INTERACTIONS BETWEEN SHARP PROBES AND FLAT SAMPLE SURFACES

Based on rigorously macroscopic arguments, a theory of van der Waals interactions between probes of various geometries and a flat sample surface is derived. While the spatial resolution of force sensing is shown to depend solely on probe geometry and probe-sample spacing, the magnitude of the force is additionally determined by the dielectric permittivities of probe, sample, and surrounding mediums. Polar immersion liquids considerably reduce van der Waals forces and may cause a transition from attractive to repulsive interactions. Apart from emphasizing some fundamental aspects, the derived results are of certain relevance to long-range scanning force microscopy.

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U. Hartmann
THEORY OF VAN DER WAALS MICROSCOPY

The ability of scanning force microscopy to detect minute forces at high spatial resolution offers the possibility to systematically map the ever-present van der Waals (VDW) forces between probe and sample. Rigorously based on macroscopic quantum field theory the presented analysis involves an ab initio calculation of VDW forces in close relation to the experimental situation. It is shown that VDW forces directly reflect surface dielectric properties of the sample under investigation. Highly polar immersion liquids present between probe and sample are shown to significantly reduce VDW forces in magnitude. Additionally, some immersion media are found to cause a transition from attractive to repulsive interactions. The lateral resolution of VDW microscopy is estimated to be in the sub-100 nm range. First experimental aspects concerning VDW force detection are presented.

*Proc. STM'90/NANO I Conference, Baltimore, USA, 1990; J. Vac. Sci. Technol. B **9**, 465 (1991)*

U. Hartmann, T. Göddenhenrich, and C. Heiden
MAGNETIC FORCE MICROSCOPY: CURRENT STATUS AND FUTURE TRENDS

Magnetic force microscopy (MFM) is a scanned probe technique for imaging microfields near surfaces of magnetic media. This brief review summarizes the basic experimental techniques and gives a sample of the results obtained so far. The major stregths and limitations of MFM are emphasized and some open questions in contrast interpretation are addressed. Future trends and new fields of application are outlined.

*Proc. EMMA'91, Dresden, FRG, 1991; J. Magn. Magn. Mat. **101**, 263 (1991)*

S. McVitie and U. Hartmann
A STUDY OF THE MAGNETIC STRUCTURE OF MAGNETIC FORCE MICROSCOPE TIPS USING TRANSMISSION ELECTRON MICROSCOPY
Proc. 49th Ann. Meet. Electr. Microsc. Soc. America (San Francisco Press, San Francisco, 1991)

R. Wiesendanger, D. Bürgler, G. Tarrach, T. Schaub, U. Hartmann, H.-J. Güntherodt, I.V. Shvets, and J.M.D. Coey
RECENT ADVANCES IN SCANNING TUNNELING MICROSCOPY INVOLVING MAGNETIC PROBES AND SAMPLES

We report on recent developments in the field of STM performed with magnetic probes and samples. The choice of appropriate magnetic sensors and their in situ preparation will be described. We further focus on the infomation obtained in spin-polarized scanning tunnelling microscopy (SPSTM) as well as on possible modes of operation for simultaneous acquisition topographic and magnetic data. The prospects for SPSTM and related magnetic sensitive SXM techniques will be discussed.

*Proc. DPG-Frühjahrstagung, Münster, FRG, 1991; Appl. Phys. A **53**, 349 (1991)*