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IAP-SEMINAR

EINLADUNG

Termin: **Dienstag, 11.5.2010 um 16:00 Uhr**
Ort: **Technische Universität Wien,**
Institut für Angewandte Physik,
Seminarraum 134A, Turm B (gelbe Leitfarbe), 5. OG
1040 Wien, Wiedner Hauptstraße 8-10

Vortragender: **Dr. Sc. Taryl Kirk**
Laboratorium für Festkörperphysik, ETH Hönggerberg, Zürich/CH

Thema: **Near Field Emission Secondary Electron Microscopy with a Scanning Tunneling Microscope**

Kurzfassung

Low beam energies have been implemented in a simplified scanning electron microscopy (SEM) technique; where the electron source, remote in standard SEMs, is brought within tens of nanometers to the object. This method, known as the “near field emission scanning electron microscopy” (NFESEM), is capable of imaging conducting surfaces with nanometer-scale resolution using beam energies less than 60 eV. The terminology “near” refers to the locality of the field-emitted electron source; which is to distinguish itself from the “remote” field emission (FE) gun sources used in standard SEMs. Furthermore it is not an optical measurement such as in scanning near-field optical microscopy, where an image is generated from exciting and collecting light diffracted in the near-field regime.

The main aim of this instrument is the realization of some kind of surface topography image due to the exposure of a primary beam of electrons, as it is rastered along the sample surface. This will be achieved by two distinct (although related) experiments: measuring the FE current while scanning and detecting the secondary electrons (SE)s generated when the electron beam impinges on the surface. A follow-up instrument, which allows for the spin polarization of the SEs to be measured, is now in the process of development. Here, the FE properties, in accordance with the tip-sample separation, will be emphasized, since the variations in SE yield are directly proportional to the impinging primary electron beam. A direct correlation between the image contrast and the FE current, where the image is enhanced with increasing FE current, has been observed. Moreover simple electrostatic measurements can be used to define the performance of the device.

It has been demonstrated that the effective emission radius is a crucial parameter in the estimation of the NFESEM resolution capabilities; therefore the resolution of the image can be used to confirm the sharpness of the emitter. C. Edgcombe has derived a direct relationship between the curvature of a Fowler-Nordheim (F-N) plot and a function describing a hemispherical barrier, as it is varied along emitter surface. Although this model was designed for a “hemisphere on a post” geometry, we have applied it to our F-N data generating a reasonable estimation of the emitter radius. However, the deduced angular spread of the beam did not yield the same range as the experimentally determined beam width. Such a discrepancy is most-likely due to the spherical nature of the emitter in the theory, as the associated equipotential surfaces deviate slowly with the polar angle at small distances. A non-spherical nanometric field emitter, which more accurately represents the angular spread, will be introduced.

Alle interessierten Kolleginnen und Kollegen sind zu diesem Seminar (45 min mit anschließender gemeinsamer Diskussion) herzlich eingeladen.

W. Werner e.h.
(Seminar-Chairperson)

H. Störi e.h.
(LVA-Leiter)