VA 3: Vacuum based Manufacturing, Coating and Analysis

Time: Monday 15:40–16:40 Location: HSZ 105

VA 3.1 Mon 15:40 HSZ 105

A 4K-UHV-Cryostat-System for Magnetic Exchange Force Microscopy with a 2-Axes-Vector-Field Magnet — •Lasse Cornils, René Schmidt, Alexander Schwarz, and Roland Wiesendanger — Institute of Applied Physics, University of Hamburg, Jungiusstrasse 11, 20355 Hamburg, Germany

Magnetic exchange force microscopy (MExFM) is utilized to study magnetic ordering with atomic resolution and single spin sensitivity in real space [1]. Being able to apply a rotatable magnetic field allows to study magnetic anisotropy effects of complex spin structures or single magnetic atoms on surfaces. Therefore an existing ultra high vacuum (UHV) cryostat [2] was equipped with a 2-axes vector field magnet allowing to apply 6T out-of-plane (z-direction) and 2T in-plane (x-direction). Up to 2T can be applied in any direction in the xz-plane. The performance of the microscope is demonstrated by atomic resolution measurements on NaCl(100).

Moreover, new features to prepare clean samples were added to the original UHV-system, e.g. a new electron beam heating stage for controlled sample temperatures between room temperature and 1800 °C.

[1] U. Kaiser, *et al.*, Nature **446**, 522-525 (2007).

[2] W. Allers, *et al.*, Rev. Sci. Instrum. **69**, 221-225 (1998).

VA 3.2 Mon 16:00 HSZ 105

Glow discharge effects in a field emission vacuum chamber — •Daniela Wenger[1,2], Wolfram Knapp[3], Bernhard Hensel[2], and Sandro F. Tedde[1] — [1]Siemens AG, Corporate Technology, Erlangen, Germany — [2]Center for Medical Physics and Engineering, University Erlangen-Nuremberg, Germany — [3]Otto von Guericke University, Magdeburg, Germany

The field emission properties of SWCNT/graphene hybrid samples were investigated in diode mode in a high vacuum chamber (10^{-8} mbar). For the application in medical X-ray systems for e.g. mammography, long pulses of more than 100 ms are necessary. The maximum current, which was achieved with short pulses, reached 400 mA (0.8 A/cm^2). Here, IV characteristics were investigated with long pulse-on times up to 500 ms. The pulse-off time was varied, resulting in duty cycles between 0% (single pulse) and 100%.

During long voltage pulses of more than 100 ms, a significant increase of the current was measured. This indicates a secondary electron emission effect, which increases the initial field emission current. We assume that the field emission electrons ignite the glow discharge of the gas molecules in the gap between cathode and anode. The glow discharge can be observed as glowing plasma between cathode and anode. Since this gap is only 100 μm wide, the local pressure is probably much higher than the chamber pressure due to geometry and outgassing due to electron scattering at the anode.

Experimental evidences of avalanche discharges will be given. The local pressure will be calculated, based on observations of the plasma.

VA 3.3 Mon 16:20 HSZ 105

Using FN Plots to Characterize Tungsten Microemitters — •Andreas Fischer[1] and Marwan S. Mousa[2] — [1]Institut für Physik, TU Chemnitz, Chemnitz, Germany — [2]Department of Physics, Mu'tah University, Al-Karak, Jordan

Tungsten microemitter tips have been prepared at variable apex radii. Various properties of these emitters were measured including current-voltage characteristics and the physical shape of the tips. Experimental results are connected to the theory for analyzing Fowler-Nordheim (FN) plots. We derived the apex radii of the tips by both SEM imaging and analyzing FN plots. The aim of this analysis is to support the ongoing discussion on recently developed improvements of the theory for analyzing FN plots related to metal field electron emitters, which in particular introduces a new form of intercept correction factors. The results derived demonstrate the applicability of the applied method on needle shaped – i.e. non planar – emitters as well as its limits.