Universität
Münster

Aktuelle Fragen
der Nanophysik

Montag, 22.01.2024 um 15:15 Uhr
R87, Wilhelm-Klemm-Str. 10

Imaging Spin Filter for NanoESCA based on Au/Ir(001) or Fe(001)-p(1x1)O

Matthias Escher

FOCUS GmbH
Hünstetten, Germany

An Imaging Spin Filter based on scattering at an Au/Ir(001) surface is presented. Used with the energy-filtered photoelectron microscope NanoESCA [1,2] is a powerful tool for various application including work-function mapping, imaging XPS and in the last years more prominently for momentum microscopy on 2D materials (e.g. see [3]).

This spin-filter that enables efficiently to image a 2D-distribution of the electron spin polarization by scattering the electrons at the polarizing target. We will show results from the first commercial build Au/Ir Imaging Spin Filter. Sherman functions of +68% and -58% were found at a reflectivity of more than 1% (also see literature [4]).

Spin-filtered images of magnetic domains show, that along the diameter of the field of view more than 100 separate image points can be resolved. This increases the effective 2D figure-of-merit of this analyzer by nearly four orders of magnitude compared to single-channel spin detectors. We also present proof of principal measurements of an Imaging Spin Filter using oxygen-passivated Fe as scattering target [5, 6]. Oxygen-passivated Fe allows for an easy switch of the polarization detection to a second polarization direction. A method to detect all three spin-components is also outlined.

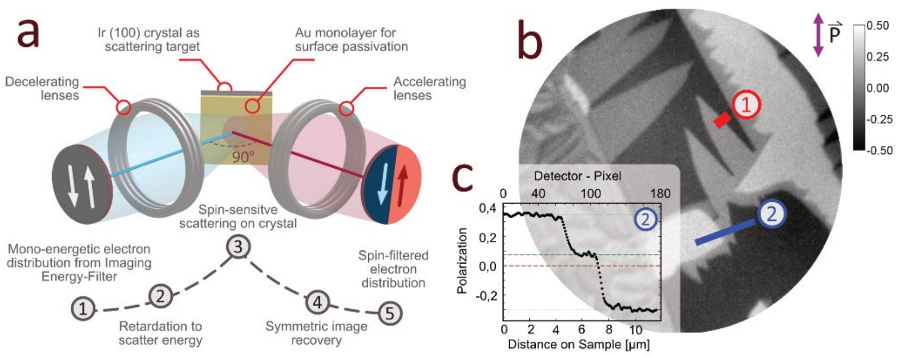

Figure 1: The monochromatic electron image delivered by the NanoESCA is spin-filtered by a scattering process (a) which allows to measure the spin polarization of the whole image simultaneously, e.g. magnetic domains of a poly-crystalline iron film (b). The field-of-view of this real-space microscopy image was set to a diameter of 66 µm. Line-scans along the domain boundaries (c) show the contrast and precision of the method.

[1] M. Escher et al., J. Phys. Cond. Matter **17** (2005)
[2] B. Krömker et al., Rev. Sci. Instrum. **79** (2008)
[3] A. Polyakov et al., Nature Comm. **13** (2022) 2472
[4] C. Tusche et al., Ultramicroscopy **159** (2015) 520-529
[5] C. Thiede et al. Phys. Rev. Appl. **1**, 054003 (2014)
[6] M. Escher et al., Ultramicroscopy **253** (2023) 113814