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In situ Thin Film Growth Capabilities for Polarized Neutron Reflectometry

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Thin magnetic films and heterostructures are the basic building blocks of many electronic information and quantum technology devices. Because sample structure, stoichiometry, and defect population are defined by and evolve with the deposition process of the structures, a precise control and optimization are of great importance, especially if magnetic and multi-ferroic properties are of interest. It is, hence, highly desirable to directly analyze the development of the physical properties of e.g. the magnetization during the growth process and to correlate it with the structural parameters of the sample.

The in situ characterization of thin films by electron- and photon-based probes or scanning probe techniques is standard. However, the in situ measurement of the magnetic properties of thin films using (polarized) neutron reflectometry ((P)NR) is an extremely challenging task.

Here, the final states of a mobile sputtering facility for in situ growth and monitoring of magnetic multilayers, which can be installed at suitable neutron beamlines, will be presented: the current state in development and the latest in situ measurements on Fe and Fe/Pd thin films will be shown. An overview over the latest developments and future modifications as well as the completion work carried out to allow the setup to be applied for even broader scientific research will be shown.

Primary author: KREUZPAINTNER, Wolfgang (Guangdong Technion)

Co-authors: YE, Jingfan; MAYR, Sina (PSI); BOOK, Alexander; INANLOO MARANLOO, Zahra (Technical University of Munich); MOULIN, Jean-Francois (HZG); STAHN, Jochen (Paul Scherrer Institut); HAESE, Martin (Helmholtz-Zentrum Geesthacht); POMM, Matthias; HEIGL, Michael; BOENI, Peter; ALBRECHT, Manfred

Presenters: YE, Jingfan; HAESE, Martin (Helmholtz-Zentrum Geesthacht); ALBRECHT, Manfred

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