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In situ Thin Film Growth for Polarized Neutron Reflectometry

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Magnetic films and heterostructures made of them or containing them are the basic building blocks of a large number of magneto-electronic devices whose fabrication is almost exclusively based on sophisticated thin film deposition techniques. The performance of the devices strongly relies on the magnetic properties of the layers they consist of. These are functions of the layers' morphology and microstructure and of the coupling between them. Since these parameters can change during the process of growth, it is highly desirable to analyse the development of the magnetic properties of heterostructures during the growth process and to correlate them with the structural parameters of the sample.
While the in situ structural characterisation of thin films during growth by various techniques is common practice (as e.g. commonly done by RHEED/LEED, STM or synchrotron radiation), the in-situ measurement of the magnetic properties of films using (polarised) neutron reflectometry is a challenging task.
Within a collaboration of TU München and University Augsburg we operate a mobile sputtering facility for the growth and in situ monitoring of magnetic multilayers, which can be installed at suitable neutron beamlines. In our contribution, the current state in development will be shown, ranging from unpolarized and polarized proof of principle neutron reflectivity measurements on thin magnetic films carried out at the ToF reflectometer REFSANS at the FRM II neutron source to the latest fast in situ PNR measurements at the AMOR beamline at PSI. For the latter, the "Selene"neutron optical concept, based on elliptic neutron mirrors is essential. An overview over the latest developments and future modifications as well as the completion work, will also be given.

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