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Ferrimagnetic films investigated by polarized neutron channeling in planar waveguides

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Recently we demonstrated enhanced sensitivity for the investigation of magnetic films with low magnetization about 100 G using a new method, namely polarized neutron channeling in planar waveguides [1]. Such films containing rare-earth elements are promising materials for magnetic recording and switching and nearly inaccessible for the conventional polarized neutron reflectometry because of weak perpendicular magnetization. We use the investigated film as a middle layer in a tri-layer planar waveguide and measure the intensity of neutron microbeam emitted from the exit face of the thin middle layer as a function of the incident grazing angle or the neutron wavelength for spin up and down. The sensitivity of the direct determination of magnetic induction is about 10 G, which is equivalent to about 0.5 permille sensitivity of the magnetization of an Fe material. In [1] we have investigated the magnetically collinear TbCo5 film. In this contribution we report new results of the investigations of the magnetically non-collinear film TbCo11 in non-saturated state. The polarization analysis of the neutron microbeam was used. The results obtained on the fixed wavelength reflectometer NREX (FRM-II, MLZ, Garching, Germany) and the time-of-flight reflectometer REMUR (IBR-2, FLNP JINR, Dubna, Russia) are presented.

[1] S.V. Kozhevnikov, Yu.N. Khaydukov, T. Keller, F. Ott, F. Radu, JETP Lett. 103 (2016) 36.

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