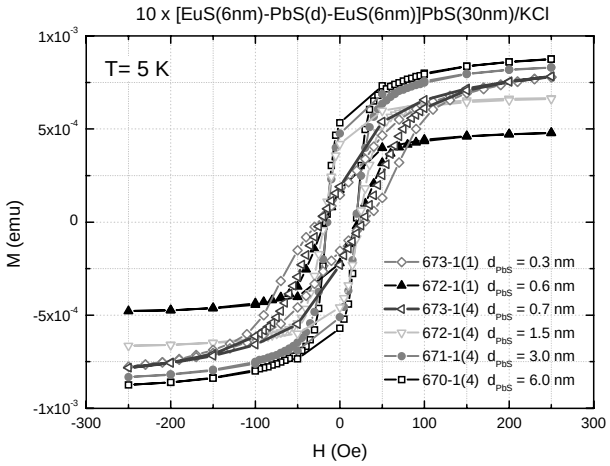
Magnetization of semiconductor EuS-PbS/KCl (001) ferromagnetic wedge multilayers

V. Osinniy[1], M. Chernyshova[1], P. Dziawa[1], L. Kowalczyk[1], T. Story[1], A.Yu. Sipatov[2], and V.V. Volobuev[2]

[1]*Institute of Physics, Polish Academy of Sciences, Lotników 32/46, 02-668 Warsaw, Poland*
[2]*National Technical University KPI, 21 Frunze Street, 310002 Kharkov, Ukraine*

In EuS-PbS semiconductor multilayers grown epitaxially along [001] crystal direction the layers of EuS (a model Heisenberg ferromagnet) are antiferromagnetically coupled *via* diamagnetic PbS spacer layer. For the experimental analysis of this effect neutron diffraction and reflectivity as well as SQUID magnetometry methods were applied to study the spacer thickness and temperature dependence of the coupling mechanism. In this work we present the analysis of the interlayer coupling in EuS-PbS multilayer wedge structures successfully grown on KCl (001) substrates with the wedges covering the PbS spacer layer thickness from 6 to 0.3 nm. The structural parameters of the wedges were examined by the x-ray measurements of the superlattice period. We discuss the measurements of magnetic hysteresis loops of EuS-PbS structures performed by both SQUID (for small terminal parts of the wedge) and MOKE (magneto-optical analysis along the wedge) magnetometry. The strong changes of magnetic remanence, coercive field and saturation field are observed for EuS-PbS structures with the PbS spacer thinner than about 1.5 nm (see in the Figure magnetization normalized per EuS layer thickness). To model the magnetic field and temperature dependence of the magnetization of these structures the temperature dependent interlayer exchange, in-plane anisotropy and Zeeman energy contributions are considered.



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Name of the presenting author (poster): Viktor Osinniy
e-mail: osinn@ifpan.edu.pl
url's: http://www.ifpan.edu.pl