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Magnetic phase diagram of Dy/Co superlattices

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Last years, interest in the Dy/Co system has increased, since it became possible to switch the magnetization of the system without applied magnetic field by means of a femtosecond laser pulses. Important requirements for achieving switchable magnetic films are antiferromagnetic coupling between spins of rare-earth and transition metals and perpendicular magnetic anisotropy (PMA). Therefore, it is crucial to find the correlation between the microstructure of thinner and thicker multilayers and their magnetic properties. The aim of this investigation was to define the influence of Dy thicknesses on the magnetic properties of Dy/Co ultilayers.
A series of [Dy (t Å)/Co (30 Å)]40 (t=4 - 20 Å) multilayers were fabricated by DC magnetron sputtering. Structural characterization of the samples was performed by Magnetic properties were investigated by VSM-magnetometry and polarized neutron reflectometry (PNR) and XMCD.X-ray reflectometry and electron-microscopic studies showed formation of DyCo intermetallic compound and Co nanocrystalline layers during the grown process. Also DyCo intermetallic layers are amorphous. The magnetization DyCo is aligned parallel to normal of sample plane, the Co magnetization is oriented in the direction of applied magnetic field. The superlattices consisting of two layers with uniaxial magnetic anisotropies is considered whose easy axes are oriented perpendicular to each other. By neutron reflectometry we observed strong increase of the intensity of spin-flip scattering which evidences increase of non-collinearity of the system. We found rich phase diagram of Dy/Co heterostructures which arising due to the competition of exchange coupling, magneto crystalline anisotropy and Zeeman energy.

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