Influence of Fe layer thickness on magnetic and magneto-optical properties of Fe/Si multilayers

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Structures containing magnetic metallic layers separated by semiconducting spacer layers attract a lot of interests because of their possible applications in the field of spintronics. In this work results of the experimental study of the Fe/Si multilayer films (MLS), prepared by magnetron-sputtering method onto (001) Si substrate, obtained by the optical and magneto-optical technique are presented. The Fe/Si MLS have been prepared with fixed Si spacer layer thickness (d_{Si}=1.1 nm) and varied Fe layer thicknesses within the range d_{Fe}=0.5-4.0 nm. The temperature dependences of the polar and longitudinal Kerr hysteresis loops for the films under study were measured in the range 10-300 K and show character typical for the antiferromagnetically coupled sublayers. The interlayer coupling depends on Fe thickness and is influenced by interfacial mixing between Fe and Si layers as it was derived from temperature dependence of magnetization processes. For thin Fe layer (d_{Fe}=0.5 nm) superparamagnetic behaviour at room temperature has been observed and ferromagnetic one at low temperature. Nonuniform nonmagnetic Fe-Si interface mixture formed during deposition plays a crucial role for the interlayer coupling observed in the systems studied.

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Poster

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