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Microstructure and magnetooptics of silicon oxide with implanted nickel nanoparticles

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Abstract

Metallic nickel nanoparticles of various sizes are formed in a thin near-surface layer in an amorphous SiO 2 matrix during 40-keV Ni + ion implantation at a dose of (0.25-1.0) × 10 17 ions/cm 2. The microstructure of the irradiated layer and the crystal structure, morphology, and sizes of nickel particles formed at various irradiation doses are studied by transmission electron microscopy and electron diffraction. The magnetooptical Faraday effect and the magnetic circular dichroism in an ensemble of nickel nanoparticles are studied in the optical range. The permittivity ε∧ tensor components are calculated for the implanted samples using an effective medium model with allowance for the results of magnetooptical measurements. The spectral dependences of the tensor ε∧ components are found to be strongly different from those of a continuous metallic nickel film. These differences are related to a disperse structure of the magnetic nickel phase and to a surface plasma resonance in the metal nanoparticles. © Pleiades Publishing, Inc., 2011.

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