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Selection rules in magneto-optics for cobalt-iron based nanocomposites

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We developed a theoretical approach based on electron gas in a metal with angular momentum coupled to magnetic field in order to explain magneto-optical (MO) properties of ferromagnetic alloys. In frames of the model the magnetic quantum number and Hund's rule can be applied for ascertaining the MO alloys properties. Hund's rule directly influences the dielectric tensor off-diagonal elements signs. Selection rules for the magnetic quantum number were applied to explain spectral ellipsometry experimental data. of (Co41Fe39B20)x(SiO2)100−x alloys. The nonrelativistic Schrödinger equation for the Co2Fe2B alloy was numerically solved in frames of quantum mechanical molecular calculus by taking into account spins of Co and Fe atoms as well as orbital moments of wave functions. Applying the modified Spicer formula for optical conductivities for different spin directions, we can obtain optical tensor off-diagonal components which are responsible for MO Kerr effect. The measured dispersion curves of off-diagonal optical conductivity of the alloys demonstrate shift of the resonant frequency to higher energies depending of percentage of non-conducting SiO2 in the samples in good agreement with the developed theory.

Topics

Session A. Physics of condensed matter and spectroscopy

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