Comment on "Enhancement of the Magneto-Optical Kerr Rotation in Fe/Cu Bilayered Films"

In a recent paper[1] experimental spectra of the magneto-optical (MO) Kerr rotation have been interpreted by assuming a new interaction phenomenon. Within the discussed model a MO-active electron transition in Fe is considered together with the plasmons in the adjacent Cu metal. This microphysical interaction should yield the measured enhancement of the phenomenological MO Kerr rotation θ_K "without interference."

A first remark is that the calculation of the angle of rotation θ_K given by Eq. (5) in Ref. 1 includes coherent multiple reflections within the Fe film exactly. It can be shown that the thickness-dependent enhancement of θ_K in the case of the Fe/Cu bilayered system is only caused by coherent multiple reflections and wave superposition within the Fe film and not additional interaction mechanism is needed to explain this interference effect. The difference between the measured and the calculated results seems to be due to the use of the wrong magneto-optical constants of the materials which are involved.

To illustrate the good agreement between the experimental results and their interpretation as a pure interference phenomenon, we present a model calculation (see Fig. 1) showing θ_K and the Kerr ellipticity ψ_K as a function of the Fe layer thickness d at $\lambda = 546$-nm wavelength. The MO effects θ_K, ψ_K shown in the diagram are calculated by using the matrix method [see Eq. (2.24) of Ref. 2] and the complex MO constants $m_{\mathrm{Fe}\pm}(\lambda = 546\ \mathrm{nm}) = 2.95 - i2.93 \pm (-0.15 - i0.029)/2$ and the complex optical constant $n_{\mathrm{Cu}}(\lambda = 546 nm) = 1.02 - i2.58$ as optical constants of the media involved. For this calculation we used measured values of θ_K and ψ_K given by Ref. 3 for the determination of $n_{\mathrm{Fe}\pm}$. The value of $\theta_K(\lambda = 546\ \mathrm{nm})$ given by Ref. 3 corresponds to the rotation angle θ_K shown by Katayama *et al.*[1] in Fig. 1 for the layer "Fe only."

Second, we want to mention that new MO measurements given by Moog *et al.*[4] (compare Fig. 3 in Ref. 4) for ultrathin Fe films support our interpretation of thin-film magneto-optical phenomena. The correct application of the matrix formalism would yield the solution for the interpretation of the experimental θ_K and ψ_K spectra in this case also.

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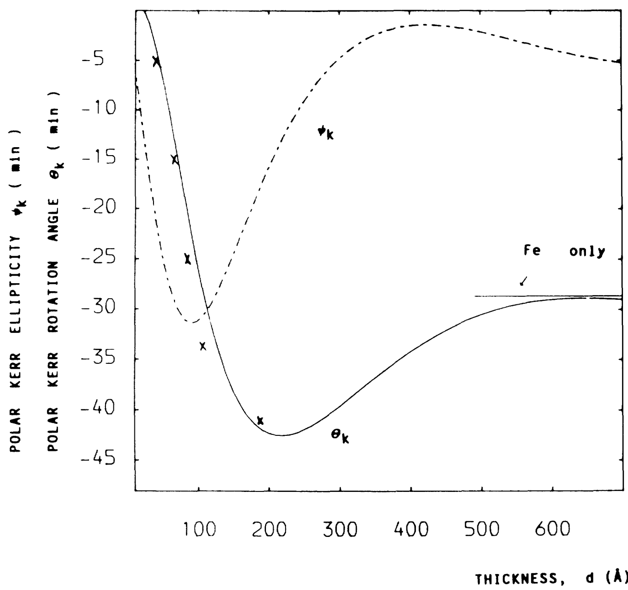

FIG. 1. Calculated thickness dependence of θ_K and ψ_K of Fe/Cu bilayered films at $\lambda = 546$-nm wavelength taking into account multiple reflections and magneto-optical superimposition effects within the Fe layer by using a matrix formalism (Ref. 2). The complex magneto-optical dielectric constants of the involved materials are the homogeneous and isolated values. The value of θ_K for Fe only corresponds to the opacity of a thick Fe layer caused by absorption. For comparison the measured values $\theta_K(\lambda = 546\ \mathrm{nm})$ given by Fig. 1 in Ref. 1 are indicated (×).

R. Nies and F. R. Kessler
Institut für Halbleiterphysik und Optik
und Hochmagnetfeldanlage
Technische Universität Braunschweig
Pockelsstrasse 4
D-3300 Braunschweig, Federal Republic of Germany

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