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Theoretical Study of Anisotropic Magnetoresistance Effect: Magnetization Direction Dependence in Ferromagnet with Crystal Field of Cubic Symmetry SATOSHI KOKADO, Faculty of Engineering, Shizuoka University, MASAKIYO TSUNODA, Graduate School of Engineering, Tohoku University, FUJUN YANG, Faculty of Physics and Electronic Technology, Hubei University, YUYA SAKURABA, KOKI TAKANASHI, Institute for Materials Research, Tohoku University, KIKUO HARIGAYA, Nanosystem Research Institute, AIST, AKIMASA SAKUMA, Graduate School of Engineering, Tohoku University — We theoretically study the magnetization direction dependence of anisotropic magnetoresistance (AMR) effect of a ferromagnet with a crystal field of cubic symmetry. We first extend our theoretical model [1] to a model including the crystal field effect. Using the model, we next obtain an analytical expression of the AMR ratio; that is, AMR(θ)=$C_0 + C_2 \cos(2\theta) + C_4 \cos(4\theta)$, where θ is the relative angle between the magnetization direction and the electric current direction. The coefficients C_0, C_2, and C_4 are expressed by a spin-orbit coupling constant, an exchange field, a crystal field, and s-s and s-d scattering resistivities. Using this expression, we analyze the following experimental results for Fe_4N [2] and Co_2MnSi Heusler alloy [3]: As for Fe_4N [2], $|C_2|$ and $|C_4|$ increase with decreasing temperature. In contrast, Co_2MnSi Heusler alloy [3] has a small temperature dependence of C_2 and $C_4 \sim 0$.
[1] S. Kokado *et al.*, J. Phys. Soc. Jpn. **81** (2012) 024705.
[2] M. Tsunoda *et al.*, Appl. Phys. Express **3** (2010) 113003.
[3] F. J. Yang *et al.*, Phys. Rev. B **86** (2012) 020409.

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