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講演会の御案内

第272回応用セラミックス研究所講演会

- 日時：平成26年6月23日（月）13:30～15:00
- 場所：J2棟20階　中会議室
- 講師：Dr. Matthias Opel (Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften, Germany)
- 演題：”Origin of the Magnetoresistance in Pt on $Y_3Fe_5O_{12}$ (YIG)”

The study of spin current phenomena in ferromagnetic metals or semiconductors is affected by charge currents occurring simultaneously. To avoid such combination and the resulting ambiguities, ferromagnetic insulators like $Y_3Fe_5O_{12}$ (YIG) have come into the focus of current research. The detection of spin currents is usually based on their conversion to charge currents in an adjacent metallic paramagnetic Pt layer, taking advantage of the inverse spin-Hall effect. Recently, magnetotransport experiments in Pt|$Y_3Fe_5O_{12}$ hetero¬structures revealed a magneto-resistance effect of Pt, displaying a hysteresis with a maximum at the coercive fields of $Y_3Fe_5O_{12}$. This unexpected observation is interpreted controversially in terms of a novel spin-Hall magnetoresistance (SMR) or a magnetic proximity magneto¬resistance (MPMR) effect .

To clarify this situation, we employ an element-specific study of the magnetic behavior of Pt|$Y_3Fe_5O_{12}$ heterostructures. Using X-ray magnetic circular dichroism (XMCD) measurements, we explore the possible existence of proximity magnetism in thin Pt films with different thicknesses ranging from 10 nm down to 1.6 nm, evaporated in-situ on epitaxial layers of the ferrimagnetic insulator $Y_3Fe_5O_{12}$. Our data unambiguously show that (if present at all) the induced magnetic moment in Pt is negligibly small and cannot account for the observed hysteretic magnetoresistance. We estimate an upper limit of (0.003 ± 0.001) Bohr magnetons per Pt atom, in contrast to a later report. We unambiguously demonstrate that a magnetic proximity effect cannot be responsible for the observed magneto¬resistance in Pt on $Y_3Fe_5O_{12}$. Our data instead strongly support the recent model of a spin-Hall magneto¬resistance effect.

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