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Quantitative analysis of spin Hall magnetoresistance in ferrimagnetic insulator/Cu/normal metal trilayer structure RYO IGUCHI, DAICHI HIROBE, KENICHI UCHIDA, Institute for Materials Research, Tohoku Univ., EIJI SAITOH, WPI AIMR and Institute for Materials Research, Tohoku Univ. — A spin current, a flow of spin angular momentum without a charge current, has been attracted much attention in spintronics. As recently demonstrated, a spin current gives rise to a new magnetoresistance effect called spin Hall magnetoresistance (SMR) owing to the interaction between charge and spin currents via the direct and inverse spin Hall effects. [1] SMR has been intensely studied in the ferrimagnetic insulator(FI)/normal metal (NM) bilayer structure both experimentally and theoretically. In contrast, it is not quantitatively investigated in the FI/Cu/NM trilayer structure. The insertion of a Cu layer, which has a long spin diffusion length, between the FI and NM layers is useful for avoiding the possible appearance of an extrinsic proximity effect in NM close to the Stoner ferromagnetic instability such as Pd and Pt. Thus, the quantitative analysis of the FI/Cu/NM system helps to clarify the origin of magnetoresistive behavior observed in the FI/NM system. We studied SMR in the trilayer structure based on the spin diffusion equation and the spin circuit theory, and found that the reported experimental results are well reproduced by our calculation. [1] H. Nakayama et.al. PRL 110, 206601 (2013).

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