Artificial Antiferromagnetic Layered Structure with Cu-Ir Spin Hall Spacer Layer

Takeshi Seki[1,2], Hiroto Masuda[1] and Koki Takanashi[1,2,3]

[1] Institute for Materials Research, Tohoku University, Sendai 980-8577, Japan

[2] Center for Spintronics Research Network, Tohoku University, Sendai 980-8577, Japan

[3] Center for Science and Innovation in Spintronics, Core Research Cluster, Tohoku University, Sendai 980-8577, Japan

Antiferromagnetic spintronics is an emerging research field and has attracted much attention because of the unique properties of antiferromagnets: zero net magnetization and small magnetic susceptibility. In addition, antiferromagnets exhibit the high speed magnetization dynamics compared with those for ferromagnets used in the conventional spintronic devices. Among various research topics in antiferromagnetic spintronics, it is a prime subject to find an efficient way for the magnetization manipulation because the zero net magnetization of antiferromagnets do not allow us to use the external magnetic field as a way for magnetization manipulation. Recent studies demonstrated that the spin-orbit torque (SOT) originating from the spin Hall effect (SHE) can act on the antiferromagnetic moments [Refs.1-3], and is a promising way to manipulate the Néel vector. However, bulk antiferromagnetic materials typically used such as NiO [Ref.1] are unsuitable for systematic SOT study because they exhibit the complicated magnetic domain structures and uncontrollable antiferromagnetic coupling strength.

In this study, we have paid attention to the artificially-controlled antiferromagnetic structures, *i.e.* “antiferromagnetically-coupled metallic superlattices”, in which the coupling strength is tuned by changing the layer thicknesses. In addition, many interfaces of a metallic superlattice may lead to the large spin-orbit interaction, resulting in the enhanced SOT. We prepared the Co / Cu-Ir / Co layered structures for the systematic investigation of interlayer exchange coupling and the SHE for Cu-Ir alloys. We have found that the Cu-Ir is a nonmagnetic spacer layer exhibiting antiferromagnetic coupling and large SHE [Ref.4].

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