EFFECTS INDUCED BY SPIN-POLARISED CURRENT IN ANTIFERROMAGNETS

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Current-induced switching of magnetization in ferromagnetic (FM) materials finds its application in the magnetic memory devices, field sensors, etc. Underlying physics is based on the *s-d* exchange interactions between conduction electrons and localized spins. While flowing from nonmagnetic to ferromagnetic layer spin-polarised electrons transfer spin torque [1] and additional magnetization [2] thus inducing reorientation or even dynamically stable rotation of localised magnetic moments. In the present paper we try to answer the question: "Is it possible to control a magnetic state of antiferromagnetic metal (AFM) using the spin-polarised dc and ac current in the reasonable interval of current densities and frequencies?"

We consider an AFM in which the magnetic ordering is due to localised moments and assume that spin torque is transferred independently to each of sublattice magnetizations. Analysis of the Landau-Lifshitz-Gilbert equations with account of spin torques in Slonczewski' form for a collinear AFM shows that stability of magnetic configuration depends upon the interplay between the value of spin-polarised current and anisotropy of the magnetic interactions. This result is different from the case of ferromagnetic materials where spin-torque competes only with internal relaxation. As a result, threshold values of currents at which switching between different stable AFM configurations takes place can be smaller than that in ferromagnetic materials especially in the AFM with small magnetic anisotropy.

If the vector of spin polarisation **p** is parallel to an easy AFM axis, the current gives rise to a shift of AFM resonance frequencies. If **p** is parallel to a hard AFM axis, the current induces stable precession of AFM vector. We found also that ac current may induce parametric resonance, downconversion and generation of spin waves.

We discuss application of the developed models to FeMn and Mn_3NiN AFMs.

[1] J. C. Slonczewski, JMMM, **159** (1996) L1; L. Berger, Phys. Rev. B **54**, (1996) 9353.
[2] Yu. V. Gulyaev, P. E. Zil’berman, E. M. Epshtein, JETP Lett., **84** (2006) 344.