Unconventional GMR angular dependence using a compensated ferrimagnet

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Abstract: We have designed a GdCo/Cu/NiFe giant magnetoresistance (GMR) trilayer, the magnetoresistance of which does not always depend on the angle between the magnetisations of the electrodes. Using a GdCo ferrimagnetic alloy close to compensation, it was possible to experimentally reach the spin flop field B_{sf} of the ferrimagnetic layer. Below B_{sf}, the ferrimagnetic layer behaves as a ferromagnetic layer, however above B_{sf}, the ferrimagnetic sublattice magnetisations are no longer antiparallel and rotate 90{ring operator} away from the GdCo layer total magnetisation, i.e. 90{ring operator} away from the applied field. The GMR responds to the angle between Co and NiFe magnetisations and not to the angle between GdCo and NiFe magnetisations. Such a structure allows to study the change of sign of the GdCo spin polarisation as a function of temperature, and details of the GdCo magnetisation when usual magnetometry is difficult. FeNi can be seen as a sensor for the in-plane component of Co sublattice magnetisation, whereas extraordinary Hall effect measurements give a complementary image of the perpendicular component of the Co magnetisation.

Author Keywords: Compensation temperature; Ferrimagnetism; Giant magnetoresistance

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