Spin dependent transport properties in MTJs having NaBr(AgBr) barriers

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Abstract

In present contribution the electronic, magnetic and spin-polarized transport properties of Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr and Fe/AgBr/Fe magnetic tunnel junctions were studied by means of self-consistent atomistic first principles calculations. A model interface with fixed atomistic structure was considered. The ballistic electronic transport properties in the current perpendicular to plane (CPP) geometry and zero bias voltages were analyzed.

The conductance decreases exponentially with the barrier thickness in case of Fe/AgBr/NaBr/AgBr/Fe MTJ. The conductance of the ferromagnetic Fe layer in the Fe/AgBr/NaBr/AgBr/Fe MTJ is enhanced by magnetic field.

Electronic structure of bulk NaBr and AgBr

Electronic structure calculations of bulk NaBr and AgBr have been performed within the framework of the density functional theory (DFT) using the Full Potential Linearized Augmented Plane Wave method (FP-LAPW).

Ground state electronic and magnetic properties

The calculated total energy and magnetic energy for Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr and Fe/AgBr/Fe systems are in good agreement with the experimental data.

Exchange coupling in Fe/NaBr and Fe/AgBr heterostructures

Exchange coupling in Fe/NaBr and Fe/AgBr heterostructures was studied through first-principles calculations. The exchange coupling constants were found to be of the order of magnitude of the exchange splitting of the Fe 3d orbitals.

Spin dependent transport properties of Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr and Fe/AgBr/Fe MTJs

The spin-dependent transport properties of Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr and Fe/AgBr/Fe MTJs were studied using the full-potential linearized augmented plane wave (FP-LAPW) method. The results show that the magnetic properties of the Fe layer are enhanced by the presence of Ag atoms in the NaBr layer.

Spin dependent transport properties of Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr/Fe and Fe/AgBr/Fe/AgBr/Fe MTJs

The spin-dependent transport properties of Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr/Fe and Fe/AgBr/Fe/AgBr/Fe MTJs were studied using the full-potential linearized augmented plane wave (FP-LAPW) method. The results show that the magnetic properties of the Fe layer are enhanced by the presence of Ag atoms in the NaBr layer.

Conclusions

- Electronic, magnetic and spin-dependent transport properties of Fe/Na\textsubscript{1-x}Ag\textsubscript{x}/NaBr and Fe/AgBr/Fe MTJs have been studied.
- Formation of sharp Fe/NaBr and Fe/AgBr interfaces have been evidenced.
- Total energy calculations performed for Fe/AgBr/NaBr heterostructures predict that Fe(001) interface geometry is energetically more stable than Fe(110) face while for Fe/AgBr/Fe multilayer structure the Fe interfaces are energetically more favorable.

References


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