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Surface and disorder novel effects on interlayer exchange coupling through magnetic tunnel junctions: Ab initio study

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Based on first principle study, we present the interlayer exchange coupling (IEC) affected by disorders in two types magnetic tunnel junctions (MTJ) structures: Fe/(MgO, Vacuum)/Fe (001) and Vacuum/Fe/(MgO, Vacuum)/Fe (001). Ferromagnetic coupling amplitude exponentially decrease with the barrier thickness, (surface case, disorder etc.)... We also study the interfacial disorder effects on the IEC through Fe/MgO/Fe(001) and Co_{0.5}Fe_{0.5}/MgO/Co_{0.5}Fe_{0.5} (001) magnetic tunnel junctions (MTJ). As the sign and IEC amplitude across MgO-based MTJ were not consistent in the literatures, which was attributed to the presence of disorder hinted by local impurities model and supercell total energy analysis. Here, we employ the surface Green's methods based on TB-LMTO to obtain IEC strength, the coherent potential approximation (CPA) method is used to clarify IEC affected by several common types of disorder in MgO based MTJ, such as oxygen vacancy, Boron and Carbon impurities. We found that the character of IEC has strong dependence on the concentration, type and distribution of disorder.

Biography

Ke Xia has completed his PhD from Nanjing University and Postdoctoral studies from TU Delft and Twente University, Applied Physics department. He is the Head of Department of Physics, BNU China since 2011. He has published more than 80 papers in reputed journals.

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