Electronic Structure and Tunneling Magnetoresistance of M/GaAs/M (001) (M=Fe, Co and Ni) Junctions

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The electronic structure of M/GaAs/M (001) (M=Fe, Co and Ni) heterostructures have been studied by means of a first principle Green's function tecnique. The conductances and the tunneling magnetoresistance ratio (TMR), in the current perpendicular-to-the plane geommetry, were calculated by means of the transmission matrix formulation of the Kubo-Landauer formalism. For all systems, the M magnetic moments at the M/GaAs interfaces as well as the magnetic coupling between the magnetic slabs are sensitive at the value of the lattice constant. Thus, for calculated equilibrium lattice constant, The M magnetic moments decrease compared with the corresponding bulk value while for the experimental value of the lattice constant, they increase in the of iron systems and remain almost unchanged for the cobalt ones. The different magnetic behavior of M atoms corresponding to the two values of the lattice spacing is a consequence of the competition between two effects named the low coordination number and the hybridization between M and sp (GaAs) states at the interfaces. Small values of the TMR ratio are obtained for all systems. The TMR ratio depends on the termination of the GaAs spacer that may be related with the electronic structure at the M/GaAs interfaces.

9.7 cm

13.4 cm

Subject category :
7. Computations of Electronic Structures

Presentation mode :
poster

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