Spin-Tunneling Time in Ferromagnetic/Semiconductor/Ferromagnetic Three-Terminal Heterojunction in the Presence of Rashba Spin-Orbit Coupling

ZHANG Ying-Tao,[1,2] XIE Zun,[1] and LI You-Cheng[1]

[1] College of Physics, Hebei Normal University, Shijiazhuang 050016, China
[2] Institute of Physics, Hebei University of Technology, Tianjin 300130, China
(Received: 2006-1-9; Revised: 2006-5-31)

Abstract: We study theoretically the transmission coefficients and the spin-tunneling time in ferromagnetic/semiconductor/ferromagnetic three-terminal heterojunction in the presence of Rashba spin-orbit interaction, in which one-dimensional quantum waveguide theory is developed and applied. Based on the group velocity concept and the particle current conservation principle, we calculate the spin-tunneling time as the function of the intensity of Rashba spin-orbit coupling and the length of the semiconductor. We find that as the length of the semiconductor increases, the spin-tunneling time does not increase linearly but shows behavior of slight oscillation. Furthermore, with the increasing of the spin-orbit coupling, the spin-tunneling time increases.

[Full text: PDF]

Close