QUANTUM WELL EFFECTS IN MAGNETORESISTANCE OF ULTRA-THIN LAYERD STRUCTURES OF FERROMAGNETIC/NONMAGNETIC SEMICONDUCTORS

J. Barnaś[a,b], S. Krompiewski[b], H.W. Kunert[c]

[a]Department of Physics, A.M. University, Umultowska 85, 61-614 Poznań, Poland
[b]Institute of Molecular Physics PAS, Smoluchowskiego 17, 60-179 Poznań, Poland
[c] Department of Physics, University of Pretoria, 001 Pretoria, South Africa

9.7 cm

In this paper we analyse theoretically the spin-valve magnetoresistance in a sandwich structure consisting of two thin films of a ferromagnetic semiconductor, which are separated by an ultra-thin layer of a nonmagnetic semiconductor. A simple parabolic band is assumed to describe electronic properties of the semiconductors (spin-split band in the ferromagnetic case). Electronic conductivity is calculated within the Boltzmann kinetic approach. Quasi-two dimensional electronic subband structure and quantum well states due to size quantization are taken into account. A quantity of particular interest is the relative change of the resistance when the magnetic configuration changes from antiparallel to parallel one, and the dependence of this ratio on the thickness of the nonmagnetic and ferromagnetic sublayers. Considerations are limited to current flowing in the plane of the structure. We found strong exponential decrease of the magnetoresistance with increasing thickness of the nonmagnetic spacer, and a more complex dependence on the thickness of the magnetic films. Variation of the magnetoresistance with the angle between magnetic moments of the ferromagnetic films is also studied.

13.4 cm

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Corresponding author :
J. Barnaś

Address for correspondence :
J. Barnaś
Department of Physics
ul. Umultowska 85
61-614 Poznań, Poland

Email address :
barnas@main.amu.edu.pl