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Investigation of Planar Hall Effect in (Ga,Mn)As/GaAs/(Ga,Mn)As Structures YINGYUAN ZHOU, Z. GE, Y.J. CHO, S. SHEN, X. LIU, J.K. FURDYNA, M. DOBROWOLSKA, Department of Physics, University of Notre Dame, Notre Dame, IN 46556, USA — We present a study of the planar Hall effect in the multilayer structures (Ga,Mn)As/GaAs/(Ga,Mn)As. The planar Hall effect (PHE) in a single (Ga,Mn)As layer yields two electric states (high and low), ideal as a basis for device design. The present paper is motivated by the speculation that a coupled (Ga,Mn) As/GaAs/(Ga,Mn)As system provides the possibility of combining PHE with tunneling magnetoresistance, thus leading to complex multiplets of electric states. Our PHE studies were carried out on coupled structures in which the two (Ga,Mn)As layers were made different by either modulation doping or by low temperature annealing. A series of specimens were prepared with different thicknesses of the GaAs spacer (3nm or 6nm). Experimental results show that for samples with 3-nm spacers the magnetic coupling between the two (Ga,Mn)As layers is so strong that their magnetizations reverse together. The PHE then behaves similar to that of a single (Ga,Mn)As layer, except that in the multilayers the PHE voltage switchings are less abrupt. In samples with 6-nm-thick spacer, however, we see the emergence of switchings with multiple values of the PHE voltage. Such multiple electric states can be qualitatively explained by modeling the coupled structures as a network of resistors.

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