Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Domain Wall Resistance in Ferromagnetic Wires RENAT SABIRIANOV, University of Nebraska at Omaha, JOHN BURTON, SITARAM JASWAL, EVGENY TSYMBAL, Department of Physics and Astronomy, and Center for Materials Research and Analysis, University of Nebraska-Lincoln — We present first-principles studies of the domain wall (DW) resistance in atomic-size cobalt and nickel ferromagnetic wires. Several types of domain walls are considered: Bloch, Neel and linear DW. The DWs are modeled using a constrained geometry with a fixed width of the non-collinear region allowing the electronic degrees of freedom to relax. Electronic structure calculations are performed using a tight-binding LMTO method in real space for monatomic wires and wires of the 4-fold-symmetry. The electronic transport properties are calculated using the Landauer-Buttiker approach. We find that DW resistance decreases very rapidly, on the scale of a few interatomic layers, with increasing DW width for both Bloch and Neel walls. The largest magnetoresistance value of about 250% is predicted for an abrupt DW in a monatomic Co wire. The density of states and the conductance of the Co wires display energy gaps in one spin channel making the magnetoresistance of an abrupt DW for these energies infinitely large. For the abrupt domain wall the large magnetoresistance is observed in some cases even if the ferromagnetic wire has conductance in both spin channels. This work is supported by National Science Foundation and Nebraska Research Initiative

Renat Sabirianov
University of Nebraska at Omaha

Date submitted: 30 Nov 2004

Electronic form version 1.4