SI-BASED MAGNETIC TUNNELING TRANSITOR WITH HIGH TRANSFER RATIO

S.H. Jang[1,2], J.H. Lee[1,2], T. Kang[1], and K. Y. Kim[2]

[1]School of Materials Science and Engineering, Seoul National University, Seoul Korea; [2]Nanodevice Research Center, Korea Institute of Science and technology, Seoul Korea

Metallic magnetoelectronic devices have studied intensively and extensively for last decade because of the scientific interest as well as great technological importance. Recently, the scientific activity in spintronics field is extending to the hybrid devices using ferromagnetic/semiconductor heterostructures and to new ferromagnetic semiconductor materials for future devices. In case of the hybrid device, conductivity mismatch problem for metal/semiconductor interface will be able to circumvent when the device operates in ballistic regime. In this respect, spin-valve transistor, first reported by Monsma [1], is based on spin dependent transport of hot electrons rather than electron near the Fermi energy. Although the spin-valve transistor showed large magnetocurrent ratio more than 300%, but low transfer ratio of the order of 10^{-5} prevents the potential applications. In order to enhance the collector current, we have prepared magnetic tunneling transistor (MTT) with single ferromagnetic base on Si(100) collector by magnetron sputtering process. We have changed the resistance of tunneling emitter and the thickness of baser layer in the MTT structure to increase collector current. The high transfer ratio of 10^{-4} range at bias voltage of more than 1.8 V, collector current of near 1μA, and magnetocurrent ratio of 55% in Si-based MTT are obtained at 77K. These results suggest a promising candidate for future spintronic applications.

[1] D.J. Monsma et al, Phys. Rev. Lett. **74** (1995) 5260