

Abstract Submitted
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Magnetic Tunneling Junction based Sensors for Bio-detection Applications¹ L.R. SHAH, Physics and Astronomy, University of Delaware, Newark DE, 19716, N. BHARGAVA, S. KIM, J. KOLODZEY, Electrical and Computer Engineering, University of Delaware, Newark DE, 19716, K. CHENG, S. SUN, Department of Chemistry, Brown University, Providence RI, 02912, R. STEARRET, X. KOU, E.R. NOWAK, J.Q. XIAO, Physics and Astronomy, University of Delaware, Newark DE, 19716 — Magnetic tunneling junctions are capable of sensing very weak magnetic fields at room temperature. It is a suitable device to detect a biomolecule which is tagged with magnetic nanoparticles. We have designed and developed Al₂O₃- and MgO- based MTJ sensors using microfabrication techniques. The study reveals that in the case of Al₂O₃-based sensors the shape anisotropy in the free magnetic electrode results in a linear and hysteresis free magnetoresistance (MR) curve. Moreover, Al₂O₃ based sensor have 28% TMR and sensitivity of up to 0.4 %/Oe over a magnetic field range of ± 40 Oe. In the case of MgO-based sensors, there are two possible methods to achieve a linear and hysteresis free MR response. One can increase the aspect ratio in free magnetic electrode, alternatively, one can use superparamagnetic free layer. MgO-based sensor has about 90% TMR and sensitivity of 1.1 %/Oe over the field range of ± 40 Oe.

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