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Anomalous Tunnel Magnetoresistance and Spin Transfer Torque in Magnetic Tunnel Junctions with Embedded Nanoparticles

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Abstract

The tunnel magnetoresistance (TMR) in the magnetic tunnel junction (MTJ) with embedded nanoparticles (NPs) was calculated in range of the quantum-ballistic model. The simulation was performed for electron tunneling through the insulating layer with embedded magnetic and non-magnetic NPs within the approach of the double barrier subsystem connected in parallel to the single barrier one. This model can be applied for both MTJs with in-plane magnetization and perpendicular one. We also calculated the in-plane component of the spin transfer torque (STT) versus the applied voltage in MTJs with magnetic NPs and determined that its value can be much larger than in single barrier system (SBS) for the same tunneling thickness. The reported simulation reproduces experimental data of the TMR suppression and peak-like TMR anomalies at low voltages available in leterature.

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