Spin-Filtering in superconducting junction with the manganite interlayer

Gennady A Ovsyannikov
Kotel'nikov Institute of Radio Engineering and Electronics RAS, Russia

The tunnel current flowing through the ferromagnetic layer between two non-magnetic electrodes becomes spin-polarized due to exchange splitting of the ferromagnetic insulator conduction band with the states with the spin up and spin down. Electronic and spin transport in superconducting mesa-structures made of epitaxial cuprate superconductor YBa_2Cu_3Ox(YBCO) and niobium thin films with an insulating manganite $LaMnO_3$ (LMO) thin film as interlayer were investigated. Ferromagnetic resonance measurements of heterostructure Au/LMO/YBCO shows ferromagnetic state at temperatures below 150 K, as in the case of reference LMO film grown on the neodymium gallate substrate. Spin current in the mesa structure was studied. The heights of the tunneling barrier in mesa structure Au/LMO/YBCO evaluated from resistive characteristics of mesa-structures at different thickness of interlayer showed an exponential decrease approximately from 30 mV down to 5 mV with increase of manganite interlayer thickness. Temperature dependence of the conductivity of mesa-structures could be described taking into account d-wave superconductivity in YBCO and a spin filtering of the electron transport. Spin filtering is supported also by measurements of magneto-resistance and the high sensitivity of mesa-structure conductivity to weak magnetic fields. Varying the external weak magnetic field $|H|<10$ Oe and dc bias current the microwave generation with a line-width of order 50 MHz was observed in GHz frequency band using low noise microwave amplifier. The frequency of generation could be tuned by biasing current with a rate 10^{13} Hz/A. The impact of spin filtering on charge current and manipulation of spin-dependent switching from oscillating to non-oscillating states are discussed taking into account the asymmetry of oscillation amplitudes over applied H-field.

gena@hitech.cplire.ru