

Tunnel spin current in superferromagnets

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Advances in micro- and nano-technologies have led to the widespread use of spintronic magnetoresistive (MR) sensors for both recording and non-recording applications. Such ultramodern magnetoresistive sensors have high sensitivity of the detected ultra-weak fields, which meet the requirements of intelligent sensor applications in the fields of the Internet, mobile devices, space technology, aeronautics, magnetic flux leakage, domotics, environment, healthcare and medicine. Moreover, their adaptability and miniaturization, simple integration and cost-effectiveness make these sensors uniquely competitive in terms of spread applications and production.

In this work, ensembles of superparamagnetic particles (SPM) imbedded in an insulator or semiconductor substrate are considered. At a sufficiently high concentration of SPMs these metamaterials show superferromagnetic properties and can be used as MR sensors [1]. We consider the electric current between the SPM particles and show that the resulting tunneling MR increases as the size of the SPM decreases.

1. 7. V. N. Kondratyev and V. A. Osipov Superferromagnetic sensors. // *Nanomanufacturing 2023*, V. 3, P. 263. <https://doi.org/10.3390/nanomanufacturing3030017>

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