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Detecting System of a Single Micro Particle by Combining GMR and Optical Tweezers

Sang-Hyun Park[1], Young-Suk Park[2], Gilwon Yoon[3], Kwang-Sup Soh[1], and Sang-Suk Lee[2]*

[1]Department of Physics and Astronomy, Seoul National University, Seoul , South Korea
[2]Department o f Oriental Biomedical Engineering, Sangji University, Wonju, South Korea
[3]Department of Electronics and Information, Seoul National University of Technology, South Korea
*Corresponding author: Sang-Suk Lee, e-mail: sslee@sangji.ac.kr

This research work has been building up the detection system of a single micro particle by using GMR and optical tweezers. A high sensitive giant magnetoresistance-spin valve (GMR-SV) bio-sensing device with high linearity and very low hysteresis was fabricated by photolithography and ion beam deposition sputtering system [1]. The GMR sensor has a characteristic to be able to detect a micros-size particle. The GMR sensor size is about 2um ×6um and the ratio of GMR is about 4% in the room temperature. The GMR biosensor was designed for the detection of the Fe-hemoglobin inside in a red blood cell and magnetic particles. When 1mA sensing current was applied to the current electrode in the patterned active GMR-SV devices, the magnitude of output of voltage signals was obtained from four-probe magneto resistive measured system, and the picture of real-time motion images was monitored by optical microscope. The particle is spherical ferromagnetic iron powder, 2-3 um. The position of the particles can be manipulated by optical tweezers. Optical tweezers is the best tool to manipulate a single biological sample whose size is a few micro meter in biology [2]. The laser is He-Ne laser whose intensity is about 10mW. In this study, we suppose that combining the GMR biosensor with optical tweezers must be a good solution to improve the detection system of magnetic properties of a single micro particle.

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Spin-current Rectification in an Organic Device

S. J. Xie[1]*, G. C. Hu[1], K. L. He[1], and A. Saxena[2]

[1]School of Physics, Shandong University, Jinan 250100, China
[2]Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM87545, USA
*Corresponding author: Shijie Xie, e-mail: xsj@sdu.edu.cn

Molecular rectifier, which may realized an asymmetric current-voltage characteristic at the molecular level, plays a curial role in the electronic logic circuits in the further nanoscale electronics. The recent progresses of experimental and theoretical researches have proved that an asymmetric molecule can act as an intrinsic charge-current rectifier [1, 2]. Although the molecular spintronics has attached much interest, such as spin injection to organic materials [3], magnetoresistance in molecular tunnel junctions [4] and spin filtering in magnetic molecule [5], the design of a functional device with electron spin is still an important topic to be involved. In this paper, we propose an organic spin diode model based on a magnetic/nonmagnetic co-oligomer structure. By performing calculation with Green function method, it is found that the charge current (CC) and spin current (SC) may be rectified at the same time or separately, which depends upon the properties of the organic molecules. We recognize a SC rectification in two forms: one is that the spin orientation keeps unchanged but the magnitude of the SC is asymmetric with the reversal of the bias; another is that the spin orientation of the SC flips with its amplitude unchanged when the bias is reversed. By designing a suitable organic spin device, either of the two kinds of SC rectifications is obtained in our calculations. Our studies suggest a possible application of an intrinsic spin diode based on the organic conjugated materials.

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