CP02

Polaron-bipolaron Transition and Spin Polarized Current in an Organic Device

Yubin Zhang[1], Junfeng Ren[2], Guichao Hu[1], and Shijie Xie[1]*

[1]School of Physics, Shandong University, Jinan, 250100, China

[2]College of Physics and Electronics, Shandong Normal University, Jinan, 250014, China

*Corresponding author: Shijie Xie, e-mail: xsj@sdu.edu.cn

Main carriers in organic materials are spin polarons and spinless bipolarons. Experimental and theoretical investigations show that polarons and bipolarons exist not independently but transform each other due to temperature, pressure, impurity or external fields. [1, 2]. An interaction model is suggested to describe the transition between polarons and bipolarons in an organic spin device (OSD). The evolutions of spin polarons and spinless bipolarons are calculated from the drift-diffusion equations [3], in which both the polaron-bipolaron transition and the spin flipping of a spin polaron are included. Then the spin polarized current is obtained. It is found that polarons are responsible for the spin polarized transport in an OSD. Different from the case in a normal inorganic semiconductor device, spinless bipolarons will affect the spin polarization intensity of an OSD. Finally, effect of the spin-flip time and the mobility of the carriers on the spin polarization are discussed.

This work is supported by the Research Fund for the Dectoral Program of Higher Education (No.20070422058)

REFERENCES

[1] Matheus Paes Lima and Geraldo Magela e Silva, Phys. Rev. B74, 224304 (2006).
[2] Shi-jie Xie, Liang-mo Mei, and D. L. Lin, Phys. Rev. B50, 13364 (1994).
[3] Yuriy V. Pershin and Vlandimir Privman, Phys. Rev. Lett. 90, 256602 (2003).

CP03

Dimerization Effect to Spin-polarized Transport in Organic Ferromagnet

Shih-Jye Sun[1]*, Chang-Feng Yu[2], and Hsiung Chou[3]

[1]Department of Applied Physics, National University of Kaohsiung, Kaohsiung 811, Taiwan, R. O. C.

[2]Department of Applied Physics, National Chiayi University, Chiayi 300, Taiwan, R. O. C.

[3]Department of Physics, National Sun Yat-Sen University, Kaohsiung 804, Taiwan, R. O. C.

*Corresponding author: Shih-Jye Sun, e-mail: sjs@nuk.edu.tw

The ferromagnetic organic polymer poly-BIPO [1] represents a candidate material for organic spintronics. The dimerization effect has been found in organic polymers [2] revealing a strong electron-phonon interaction in organic compounds. We theoretically investigate the dimerization effect to a metallic electrodes contacted poly-BiPO, the length scale of the sample is 30 atomic sties, and the spin-polarized currents are calculated by keldysh greens function method. In the comparison with the spin-polarized currents for dimerized and non-dimerized poly-BIPOs, the dimerization reduces the spin-polarization of the current (SP), and the inter-site Coulomb interaction enhances the SP as shown in Fig. 1. Fig. 2 shows the spin polarizations of the itinerant carriers for dimerized sample at every atomic site are smaller than non-dimerized sample.

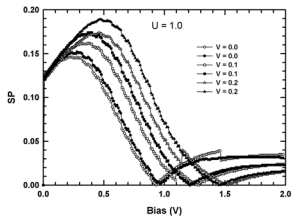

Fig. 1. The spin-polarization of the current (SP) as the function of bias for different inter-site Coulomb interactions. The open symbols represent dimerized poly-BIPO and the solid symbols represent non-dimerized poly-BIPO.

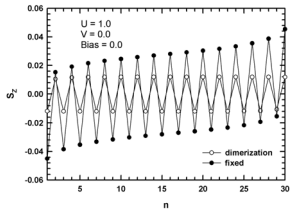

Fig. 2. The spin polarization of the itinerant carriers (Sz) at every atomic site (n) for dimerized (open symbol) and non-dimerized (solid symbol) samples. The dimerizaiton reduces the spin polarization.

REFERENCES

[1] Y. V. Korshak, T. V. Medvedeva, A. A. Ovchinnikov, V. N. Spector, Nature 326, 370 (1987).
[2] W. P. Su, J. R. Schrieffer, A. J. Heeger, Phys. Rev. Lett. 42, 1698 (1979); Phys. Rev. B 22, 2099 (1980).