Spin polarized conductance in ferromagnet / insulator / conventional superconductor junctions

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The modified Blonder-Tinkham-Klapwijk (BTK) theory has been successfully used to describe the current-voltage characteristics of ferromagnet / insulator / conventional superconductor contacts. The spin polarization P of the Andreev reflection measurements for ferromagnetic materials has been normally determined by using the modified BTK theory[1]. However, the modified BTK theory assumes the elementally sum of only two currents of the fully-polarized state and the non-polarized state. Therefore, based on the BTK theory, we here suggest another theoretical model of the spin polarized conductance $\sigma(eV)$ in the system of ferromagnet / insulator / conventional superconductor contacts. We consider the exchange potential $U_{\rm ex}$ of the ferromagnetic materials corresponding to the parameter of the spin polarization. The zero-bias conductance $\sigma(0)$ gradually decreases with the increase of $U_{\rm ex}$ because the Andreev reflection is suppressed at the junction interface of ferromagnet / superconductor contacts in the case of finite values of $U_{\rm ex}$. Finally, we discuss fitting results of $\sigma(eV)$ and P for Heusler alloy/Pb planar junctions with the theoretical model.

[1]Y. Ji, G. J. Strijkers, F. Y. Yang, C. L. Chien, Phys. Rev. B **64**, 224425 (2001).