ELECTRON TUNNELING: FROM MAGNETIC TO FERROELECTRIC TUNNEL JUNCTIONS

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In recent years spin-dependent tunneling in magnetic tunnel junctions has aroused enormous interest and developed into a vigorous field of research. Extensive efforts, both in theory and in experiment, have been made to elucidate the mechanisms of spin-dependent tunneling. This talk will overview major factors controlling the spin polarization of the tunneling current in epitaxial magnetic tunnel junctions. In particular, we will discuss the decisive role of evanescent states in the insulating barrier layer and the electronic structure of the ferromagnet-insulator interface [1]. Stimulated by experimental observations of ferroelectricity in thin films of a nanometer thickness, we will consider a new class of tunnel junctions which utilize a ferroelectric material as a barrier layer [2]. In such ferroelectric tunnel junctions (FTJs) the conductance may depend strongly on the direction of the electric polarization [3,4]. This property makes FTJs appealing for application as resistive switches and non-volatile memory cells. Using a ferroelectric barrier in a magnetic tunnel junction makes it multiferroic, where ferromagnetic electrodes are separated by a ferroelectric barrier. Multiferroic tunnel junctions (MFTJs) have the potential to provide an additional degree of freedom in controlling the conductance.

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[3] M.Y. Zhuravlev et al., *Phys. Rev. Lett.* 9**4**, 246802 (2005).

[4] J.P. Velev et al., *Phys. Rev. Lett.* **98**, 137201 (2007).