Spintronics and Chirality: Spin Selectivity in Electron Transport through Chiral Molecules

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ABSTRACT

Recent experiments have demonstrated that the electron transfer through chiral molecules depends on the electron spin orientation. This phenomenon has been termed the chiral-induced spin selectivity (CISS) effect [1-2], and it provides a challenge to theory and promise for organic/inorganic molecule-based spintronic devices. Organic semiconductors and organic-inorganic hybrids are promising materials for spintronic based memory devices. Recently an alternative route to organic spintronic based on CISS effect has been suggested [3]. In the CISS effect, the chirality of the molecular system itself acts as a spin-filter, thus avoiding the use of magnets for spin injection. Techniques for measuring spin-selective electron transport through molecules and some examples of recent experiments will be discussed [4-7]. By studying spin-dependent electron transport through various bio-molecules (like DNA, peptides, proteins, etc), supramolecular structures, organic/inorganic chiral molecules, we can able to describe the possible application of the CISS effect for developing new kinds of memory devices. Such memory would be based on spintronics, the use of the electrons' spin, rather than charge. Furthermore, the CISS effect is a multidisciplinary phenomenon with implications in chemistry, physics and biology; therefore, this field has many-fold directions and will open new avenues for scientific and technological exploration.

References:

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