Recent progress in hybrid organic/inorganic heterostructures for potential magnetoresistive applications

Jean-François Bobo*†[1]

[1]Centre d'élaboration de matériaux et d'études structurales (CEMES) – CNRS : UPR8011 – 29 Rue Jeanne Marvig - BP 4347 31055 TOULOUSE CEDEX 4, France

Abstract

My course will be focused on the recent progress in the study of a new class of devices based on hybrid inorganic metal and organic semiconductor heterostructures and their potential for magnetoresistive applications.
Organic spintronics, a fusion between organic electronics and spintronics, is a new and promising research field where organic materials are used to mediate or control a spin-polarized signal. The field of organic spintronics is particularly attractive due to the potentially very long spin relaxation times in OSC. One of the main advantages with OSC is that they allow chemical tuning of their physical properties such as electronic gap, injection barrier, mobility, spin-orbit coupling and hyperfine interaction.

Basically, organic spintronics can be divided into two classes: OMAR (organic magnetoresistance) and OGMR (organic giant magnetoresistance). OMAR devices structures are based on one OSC layer sandwiched between non-magnetic electrodes. OMAR effects, - the change in resistance with magnetic field, - result from intrinsic magnetic field effects on the electronic levels involved in charge transport. The latter - organic spin valves (OSV or OGMR) are different from OMAR since they contain ferromagnetic electrodes. They are constituted of three active layers: a first, "soft" ferromagnetic electrode layer; a spacing layer (OSC); and a second, "hard" ferromagnetic electrode layer. They are designed to exhibit either a high or low resistance, depending on the carrier electron spin alignment in the magnetic layers.

I will present an overview of such effects and the associated materials, techniques and models used in their study.

*Speaker
†Corresponding author: jean-francois.bobo@cemes.fr