SOLEIL SYNCHROTRON

Réunions scientifiques

Séminaires

Origin of mechanisms controlling conducting properties of the surface transfer doped Ag/Si(111)-(√3x√3) surface

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Invité par M.C. Asensio

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Doping mechanisms that extremely populate low-dimensional systems introducing a negligible defect concentration are key for developing new low-dimensional devices. The called surface transfer doping (STD) mechanism offers promising perspectives satisfying these requisites. STD promotes the inhomogeneous doping of a semiconductor by carrier exchange with dopants situated at its surface which also ensure donated carriers to be confined at the semiconductor surface due to the electrostatic potential established by the charge separation. This unconventional kind of doping seems to be the method of choice for manipulating conductivity of nanotubes and has been successfully applied to fullerenes deposited on hydrogen-terminated diamond surfaces. Also highly doped two-dimensional (2D) conducting channels can be created in silicon surfaces by STD or by similar mechanisms mediating surface atomic rearrangement.

STD appears to be behind the tuning of the conducting properties of a large variety of hot systems in material science that may exhibit still unexplored common features. In particular, STD systems would be expected to suffer from an enhancement of long-range Coulomb interactions at similar carrier densities due to the absence of spacer layer, in comparison to high-speed electronic devices. Consequently, their conducting behaviour would critically depend on the balance between the disorder potential felt by carriers and its screening, in a way that may exceed the frame of the standard screening theory of 2D systems if other electron-electron interaction effects were neglected. How this balance is bent would be determinant to clarify the conducting properties of STD systems and even if they may conduct in an exotic state.

In order to establish a basic frame to analyse the conducting properties of 2D STD systems, we have selected the so studied (but still with some lacunas) STD Ag/Si(111)-(√3x√3) system. In this lecture, we show that a semiclassical transport model of this surface is able to quantitatively explain the doping dependence of the sheet conductance obtained experimentally. In order to develop this model, a detailed analysis of the photoemission spectra has been carried out. The role played by the Coulomb interaction and the effectiveness of its screening will be discussed.

Formalités d'entrée *: accès libre dans l'amphi du Pavillon d'Accueil. Si la manifestation a lieu dans le Grand Amphi Soleill du Batiment Central, merci de vous munir d'une pièce d'identité (à échanger à l'accueil contre un badge d'accès).*

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