SELF-ASSEMBLED CARBON NANOTUBE DEVICES

S. Auvray, J. Borghetti, P. Chenevier, V. Derycke, A. Filoramo, L. Goux-Capes,
M. Goffman, R. Lefevre, K. Nguyen, **J.P. Bourgoin**
Laboratoire d'**E**lectronique Moléculaire, DSM/DRECAM, CEA Saclay
91191 Gif/Yvette France
E-mail: jbourgoin@cea.fr
http://www-drecam.cea.fr/scm/LEM/index.html

During the last five years, Molecular Electronics has seen very significant advances and raised prospects of mid-term applications [1,2]. In this talk, the focus will be on self-assembly which is generally considered as the way of choice for the fabrication of future molecular electronics circuits. Self-assembling molecules into devices has been used during the last few years with the aim to engineer i)metal-molecule or more generally metal-nanoobjects interfaces to improve their transport properties and ii)molecule-surface interactions to localize the self-assembly of the nanoobjects.

It will be shown how carbon nanotubes(NTs) can be self-assembled at predefined location of a substrate using for example a localized functionalization of the substrate by a self-assembled monolayer [3]. Various examples of the versatility of this generic technique will be presented including the fabrication of single electron transistors, of junctions, of field effect transistors (FET). For example, the FET devices prepared in that way are functional with state-of-the-art performances [4]. The role played by the environment (including that of the self-assembled monolayer directing the deposition of the NTs and that of molecules adsorbed on the NTs) on the devices characteristics will be discussed. It will be shown in particular how a chemical treatment of the devices can be used to improve drastically the performances of the carbon nanotube FET [5]. In addition, further elaborating upon the chemical tailoring of the CNTFET devices, a new class of devices consisting of optically gated CNTFET has been developed and will be presented.

As another example of application of this self-assembling technique, new nano electromechanical systems based on nanotubes will be presented and shown to function as switches.

Finally, the improvements of the self-assembling technique using the recognition properties of biomolecules will be presented.

References:

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