INTERCONNECTION OF NANOTUBES THROUGH DNA LINKER

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Single wall carbon nanotubes (SWNTs) occupy a special place within molecular electronics. Indeed, they exist as semiconducting or metallic wires and have been used to demonstrate molecular devices like transistors, diodes or SET (single electron transistor) [1]. However, the future of this class of SWNT-based devices is to a large extent related to the development of a bottom-up self-assembly technique. Our laboratory was pioneer in the use of self-assembled monolayers (SAMs), which modify the surface properties of a prepatterned substrate [2]. We obtained by this way the suitable high densities of SWNTs deposition necessary for the realisation of integrated devices [3]. Such positioned SWNTs have been electrically contacted to realize high performance transistors, which very well compare with state-of-the-art carbon nanotubes field effect transistors [4]. However, in this approach the patterns and the electrodes are realized by standard lithographic techniques. A real technological breakthrough would be to develop a complete molecular scale bottom-up method.

The exceptional recognition properties of DNA molecule make it an ideal candidate for realizing a site-controlled implementation of nanocomponents. Among the several key points required to perform SWNTs devices network assembled on DNA scaffold, one of them is to control SWNT-DNA binding. Here we present a simple and versatile method for linking single wall carbon nanotubes (SWNT) to DNA by non-covalent chemistry using streptavidin-biotin recognition complex.

Streptavidin coated SWNTs are reacted with biotin or bis-biotin ended DNA double strands leading to SWNT-DNA and SWNT-DNA-SWNT adducts in high yield (see Figure 1). This method avoids strong acidic treatment of SWNTs prior to functionalization as usually required in covalent routes. Complementary characterizations by gel electrophoresis and AFM demonstrated the efficiency of the present binding method. In addition, SWNTs bound to DNA can be aligned on a substrate using the combing properties of DNA strands, bringing a new tool into the toolkit for self-assembling SWNTs onto surfaces.

References:

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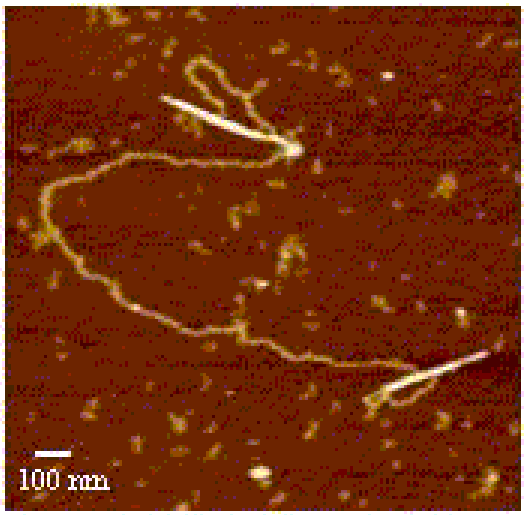

Figure1: AFM image of two SWNTs linked by a DNA strand.

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