

Electronic Detection of Biomolecules by Carbon Nanotube Field Effect Transistors

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The integration of biomaterials with carbon nanotubes, CNTs, has promoted an interdisciplinary field of CNT-based nanoelectronics and nanobiotechnology. The quick detection of anomalous genes responsible for a congenital disease is highly desired and the reading of the human genome has opened the possibility of early detection and diagnoses of congenital/terminal diseases (1).

Electronic sensor arrays based on carbon nanotubes field effect transistors, CNTFETs, have been prepared and used for the detection of DNA hybridization. A new approach for the attachment of DNA single sequences to the CNTs has been developed. The resulting DNA functionalized CNTs have been successfully used for the electronic detection of DNA hybridization. The polymer poly (methylmethacrylate_{0.8}-co-polyethyleneglycol methylmethacrylate_{0.1}-cosuccinimidyl methacrylate) has been synthesized and bonded non-covalently to the CNT followed by the covalent attachment of an aminated DNA single strand, ssDNA-NH₂, Figure 1.

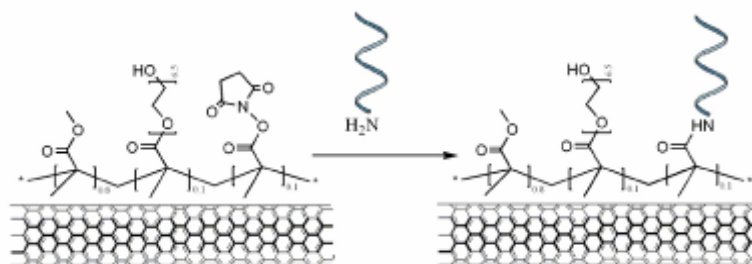


Figure 1.- Schematic representation of the bonding of the polymer to SWNT and ssDNA-NH₂

Then the possible succinimidyl groups remaining in the polymer were blocked with ethanol amine before ssDNA hybridization to avoid non-specific adsorption of other protein or biomolecules.

For DNA detection studies, chips of 896 devices per square centimetre have been prepared and the devices having transistor behaviour have been analyzed.

The results, Figure 2, indicated that there are statistically significant changes in the sensor what make feasible the electronic detection of DNA hybridization.

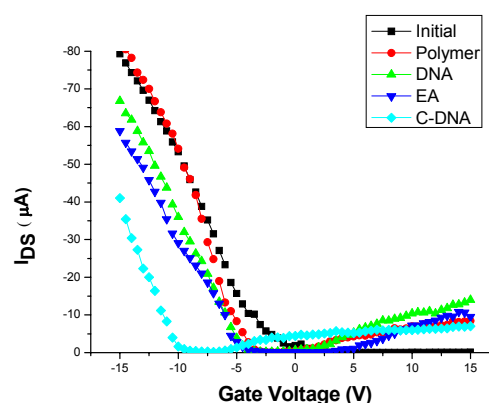


Figure 2.- I-V plots of a representative device through the different sensing steps

[1] Katz, E., Willner, I. ChemPhysChem, 2004, 5, 1084-1104