Functionalization and characerization of CNTs by means of water plasma

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Carbon nanotubes (CNTs) produced by Plasma Enhanced Chemical Vapor Deposition (PECVD) show particular structural and morphological characteristics suitable for different applications like energy and charge storage , environment, biomedicine, electrochemistry or photonics [1].
In order to modify their physical and chemical properties, the surface of the nanotubes can be functionalized with chemical groups, expanding their potential application in the energy and environmental fields. The easiest way to covalently attach chemical groups like, e.g., carboxylic groups, is by oxidation such as acid oxidation, air oxygen oxidation, ozone oxidation, and plasma oxidation, resulting in the formation of hydroxyl, carbonyl and carboxyl groups on the surfaces of the nanotubes. However, due to the rather harsh conditions involved, most oxidation reactions result in the opening of the nanotube tips, detrimental damage of their sidewalls, or both [2].
In this work, vertically aligned carbon nanotubes (VACNTs) were prepared by means of PECVD and functionalized with water plasma treatments [3] (Figure 1). The oxidation process was optimized adopting a Box-Wilson experimental design using the pressure and plasma power as the operational parameters. The water-plasma treated CNTs were characterized by SEM, TEM, Raman Spectroscopy, XPS and contact angle. The results allow us to describe the functionalization process as a function of water pressure and plasma power.

References

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[3] F. Javier del Campo, J. García-Céspedes, F. Xavier Muñoz, E. Bertrán, Electrochemistry Communications, 10, 1242–1245, 2008.

Figure

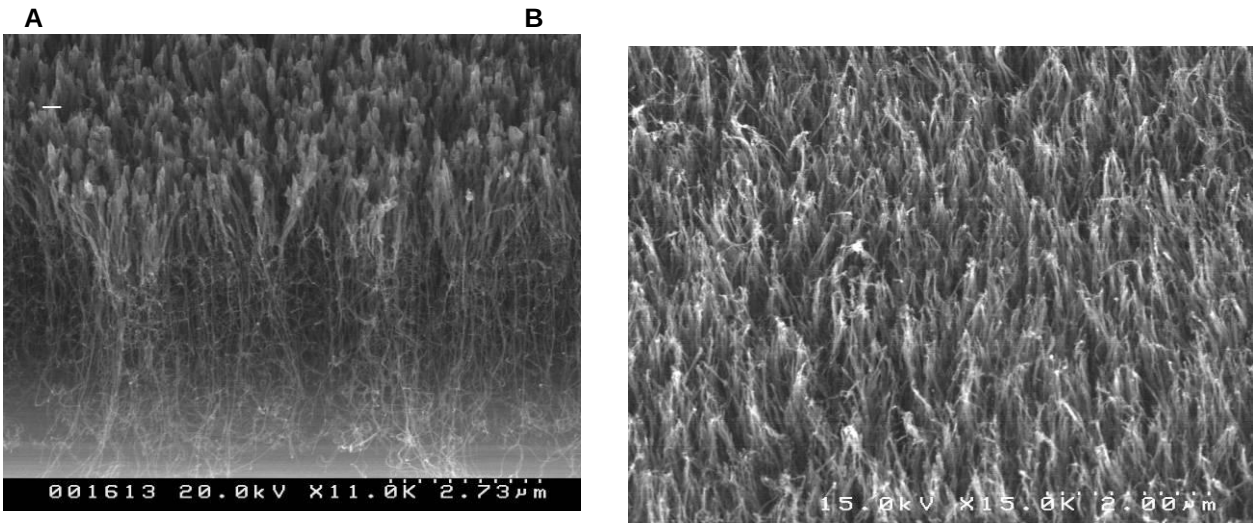

Figure 1 A. CNTs grown by PECVD without water plasma treatment. B. CNTs grown by PECVD after water plasma treatment.