Plasma Oxidation of Multi-walled Carbon Nanotube Sheets

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Carbon nanotube (CNT) based materials are gaining new trend at the materials science field due to their extraordinary properties [1]. Such kind of materials as carbon nanotube yarns [2] forests [3] and sheets [4] have many applications as reinforcements in polymer composites [5], actuators [6], catalyst supports [7] and scaffolds for biomineralization assays [8]. Our work is focused on Carbon Nanotube sheets (so called buckypapers) which are nano-porous, self-standing materials made by randomly distributed MWCNTs. MWCNT sheets are produced by vacuum filtration process and their average thickness is in the range of 50-150μm. Common functionalization techniques of CNTs' surface are chemical and electrochemical treatments. The technique that used in this work is oxygen plasma treatment. Plasma treatment has advantages of low treatment time (seconds as compared to hours of chemical oxidation) and of a non-wet process that makes plasma treatment ideal for industrial grade processing. Thus we managed to oxidize MWCNTs sheets' surface by oxygen plasma treatment. A study by Raman spectroscopy revealed that plasma oxidation degrades the graphitic structure of MWCNTs. A full XPS and TGA study occurred to examine the defect production for different exposure times and to specify oxidation degree. Morphological study by SEM showed that flattening of MWCNT sheet rough surface is analogous to plasma exposure time. Also maximum etching of MWCNT sheets' surface was carried out at first minute of plasma exposure process. Additionally TEM pictures of degraded MWCNTs, contact angle measurements and surface topography analysis of MWCNT sheets will be presented at conference.

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