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**Enhancement of CNT-based filters efficiency by ion beam irradiation**

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**Abstract**

It is shown in the report that disorder produced by ion beam irradiation can enhance the functionality of the carbon nanotubes. The filters of pressed multiwalled carbon nanotubes (MWNTs) were irradiated by He<sup>+</sup> ions of the energy  $E=80$  keV with the fluence  $2 \times 10^{16}$  ion/cm<sup>2</sup>. The removal of manganese from aqueous solutions by using pristine and ion beam irradiated MWNTs filters was studied as a function of pH, initial concentration of manganese in aqueous solution, MWNT mass and contact time. The filters before and after filtration were characterized by Raman (RS) and energy dispersive X-ray spectroscopy (EDS) techniques to investigate the deposition content in the filter and defect formation in the MWNTs. The irradiated samples showed an enhancement of removal efficiency of manganese up to 97.5% for 10 ppm Mn concentration, suggesting that irradiated MWNT filter is a better Mn adsorbent from aqueous solutions than the pristine one. Radiation-induced chemical functionalization of MWNTs due to ion beam irradiation, suggesting that complexation between the irradiated MWNTs and manganese ions is another mechanism. This conclusion is supported by EDS and RS and is correlated with a larger disorder in the irradiated samples as follows from RS. The study demonstrates that ion beam irradiation is a promising tool to enhance the filtration efficiency of MWNT filters.

**Keywords:** MWNTs irradiation, Defect formation, Raman spectroscopy, Efficiency enhancement, Metal contaminant removal, Chemical functionalization.

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