EFFECTS OF ION IRRADIATION ON ELECTRICAL PROPERTIES OF CARBON NANOTUBES

A. R. Vaz[1], J. Leon[2], C. Verissimo[1], M. M. da Silva[1], S. A. Moshkalev[1], R.V. Gelamo and J.W. Swart[3]

[1] Center for Semiconductor Components - CCS, UNICAMP, C.P. 6061, CEP 13083-870, Campinas, SP, Brazil ,[2] Physics Institute - UFMG, Belo Horizonte, MG, Brazil, [3] Center for technology of Information – CTI, Campinas, SP, Brazil

Carbon nanotubes (CNT) attract much interest due to combination of exceptional electrical, mechanical, optical and other properties, with many potential applications in micro and nanodevices like sensors and other MEMS (micro-electromechanical systems). These properties can be further modified to provide, for example, selective sensitivity to different gases when CNT decorated with different metal and metal oxide nanoparticles are used in chemical sensors. [1] Systematic study of characteristics of CNT and its composites, as well as fabrication of CNT based devices, require development of reliable technologies for successive growth or deposition, manipulation, contacting, processing, and measurements of electrical, optical, magnetic and other properties of individual CNTs or their films.

For this, integration of these technologies and analysis of their compatibility is extremely important. It is necessary to determine conditions when the processes employed result in negligible (or at least, controllable) changes in the properties of processed nanotubes. In particular, focused ion beam (FIB) are frequently used in micro and nanofabrication to produce nanocontacts by ion-induced metal deposition. However, the effects of ion beam irradiation on the properties of nanotubes and nanoparticles is yet poorly characterized and need detailed studies.

In this work we study the effects of ion irradiation, promoted by focused ion beam (FIB), on the electrical properties of suspended CNTs (Fig.1). Metal electrodes were prefabricated by lithography and FIB milling processes (Fig.2). Multi-wall CNTs were deposited between metal electrodes using a dielectrophoresis method. [2] Both supported and suspended nanotubes were studied. Electrical contacts between CNTs and metal (Pd) electrodes were improved with Pd or Ni deposition by electroless process ou by FIB-deposited Pt. Electrical properties of suspended CNTs were measured before and after ion irradiation, using 2 and 4 terminals methods.[3] Preliminary results are showing in the Figure 3.

1. R.V. Gelamo *et al., Ibersensor* (2008), São Paulo, Brazil, p. 60
2. R. Krupke *et al*., *Appl. Phys.* **A 76**, 397 (2003)
3. A. R. Vaz *et al*., *Journal of Materials Science* **43(10),** pag. 3429-3434 (2008)

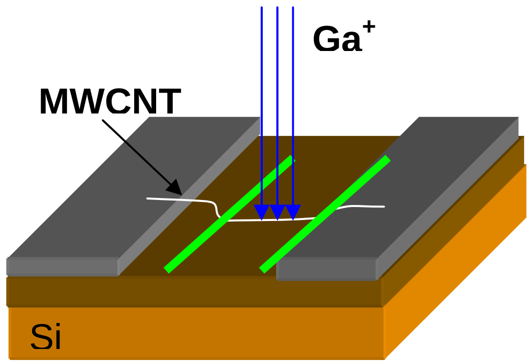

Figure 1 – Setup for electrical measurements.

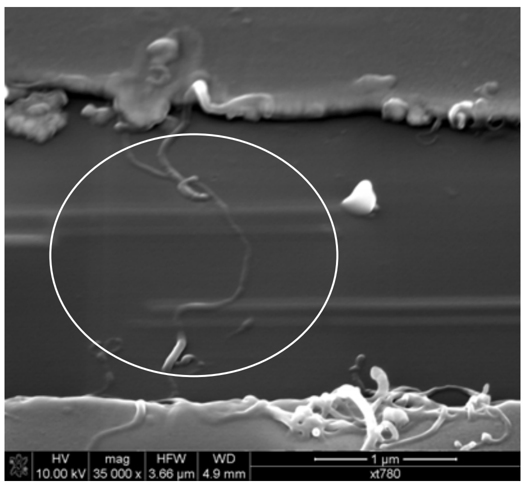

Figure 2 – Carbon Nanotubes deposited by dielectrophoresis and irradiaded with ion beam.

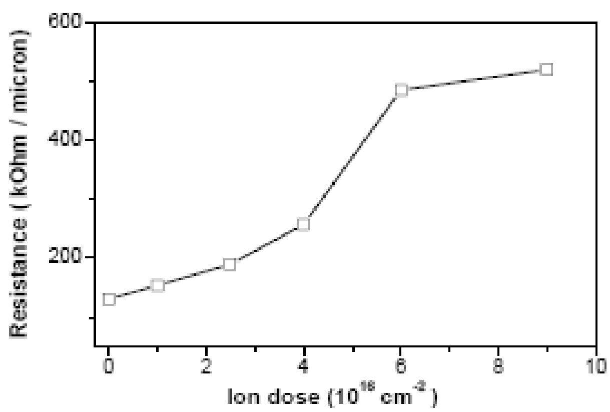

Figure 3 – Measurements of resistance after irradiation.