5 MEV CARBON IONS IRRADIATION-INDUCED CHANGES IN PROPERTIES OF NICKEL NANOWIRES MESH

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1-Aims & Objectives

- To modify the optical and electrical properties of Nickel Nanowires (Ni-NWs) meshes by carbon ions irradiation.

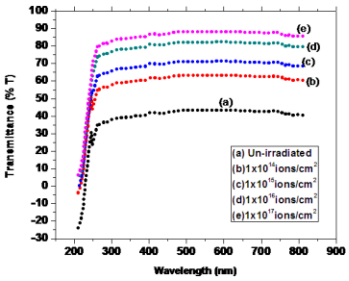
2-Background

- Strongly conductive networks of metal nanowires (MNWs) are imperative for the stream of charge carriers in many new technologies today [1].
- Damage to nano-structured materials on exposure to energetic ions has been a general misconception but recent research has proved it to be a tool for tailoring electronic [2,3], optical [4], and magnetic [5] properties and changing the structure [6] of nanomaterials in a simple manner.
- In this work, we employed ion beam irradiation technology as a tool to modify the properties of Ni-NWs.

3-Experimental Section

- The average diameter of Ni-NWs was about approx. 300-500nm. The average length of pristine Ni-NWs was 100-200 µm.
- The solution of Ni-NWs was deposited on glass substrate using drop casting method. The samples were thereafter subjected to ion beam irradiation at 5 MeV **C^+ ions** at room temperature, which the beam fluencies ranging from 1 $x10^{14}$ to $1x10^{17}$ ions/cm^2 using a 5UDH-Pelletron accelerator.
- The morphology and structure of both un-irradiated and irradiated Ni-NWs networks were characterized using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and x-ray diffraction (XRD) techniques. Optical and electrical measurements were made using UV-VIS spectroscopy and four probe techniques. The conductivity was calculated by a four-point probe technique.

4-Results & Discussions



Before and after exposure of Ni-NWs meshes to C^+ ions, the optical transmittance spectra are given in Figure 1 (a-e).

- **The optical transparencies of Ni-NWs meshes are increasing with increase in fluence of C^+ ions. Increment in optical transparency of Ni-NWs meshes may be attributed to thinning of Ni-NWs under the influence of C^+ ions beam irradiation.**

- **To confirm the stability of structure of 5 MeV C^+ ion beam irradiated Ni-NWs, XRD measurements were performed at room temperature and are shown in Figure 2.**

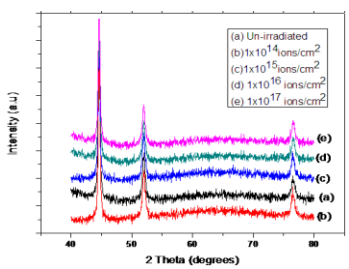


Figure 2: XRD patterns of Ni-NWs at different ion irradiation doses.

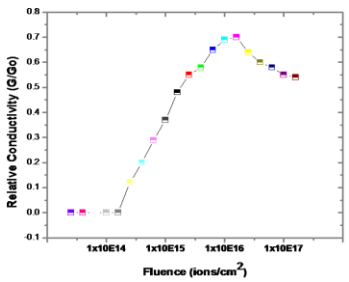


Figure 3: Electrical conductivity (relative i.e., G/G_o) of Ni-NWs meshes as a function of fluence of C^+ ions.

5-Conclusions

- The present C^+ ions irradiation technology was proved to be a superb approach to modify electrical conductivity and optical transparencies of nickel nanowires.

References

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