

## Abstract

The surface morphology, structural changes, chemical and functional bonding and electrical properties of nitrogen ion irradiated graphite samples have been investigated. The graphite samples were implanted with nitrogen ion beam of energy 500 keV using 2 MeV pelletron accelerator. Energy of the beam remained same for all the samples but ion doses varied. The samples were implanted at doses  $10^{13} \text{ cm}^{-2}$ ,  $5 \times 10^{13} \text{ cm}^{-2}$ ,  $10^{14} \text{ cm}^{-2}$ , and  $5 \times 10^{14} \text{ cm}^{-2}$ . FE-SEM images revealed the structural modification of graphite resulting from nitrogen ion implantation. The flake like morphology of graphite was replaced with spherical grain like structure of solid carbon nitride. X-Ray diffraction results showed a change in lattice parameters as well as in ordering of the graphite crystal lattice. Lattice parameters decrease for ion dose  $10^{13} \text{ cm}^{-2}$  and then increase with the increasing ion doses. Variation in crystallite size is also observed. The maximum crystallite size of graphite is calculated for ion dose  $5 \times 10^{13} \text{ cm}^{-2}$ . A variation in d-spacing depicts the induction of strain in the lattice. FTIR results proved the formation of carbon and nitrogen bonds. In Raman Spectroscopy results G, D and 2D bands are observed which is the Raman signature of graphitic  $\text{sp}^2$  carbon materials. Moreover, Raman shift further confirmed the Carbon nitride formation in nitrogen implanted graphite samples. A significant change in electrical properties of graphite is observed. The electrical conductivity of graphite increases with the nitrogen ion doses  $10^{13} \text{ cm}^{-2}$  and  $5 \times 10^{13} \text{ cm}^{-2}$  and then decreases as the ion doses are increased to  $10^{14} \text{ cm}^{-2}$  and  $5 \times 10^{14} \text{ cm}^{-2}$ . The maximum value of electrical conductivity is calculated for nitrogen ion dose  $5 \times 10^{13} \text{ cm}^{-2}$  i.e.  $9.7 \times 10^5 \text{ mho-m}^{-1}$ . Best results are observed for the nitrogen ion dose  $5 \times 10^{13} \text{ cm}^{-2}$ .