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Heav Ion Beam Analaysis of Ion Implanted Polymer Nanocomposites

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Ion Beam Analysis (IBA) is a suite of techniques used to determine elemental composition and depth profiles of thin film materials. Ion beam induced damage in soft insulating materials like polymers can be a limiting factor to the accuracy of IBA especially when using heavy ions. The usability of Heavy Ion Elastic Recoil Detection Analysis (ERDA) at iThemba LABS for analysis of polymeric films is presented in this work. The primary aim of the work was to optimize the applicability of the technique towards depth profiling ion implanted species in polymer films using different heavy ions of Au⁷⁺ and Cu⁵⁺. The films were implanted with different ion fluences of 80 keV Ti⁺ ions ranging from 5×10^{15} to 5×10^{16} ions/cm² at liquid nitrogen temperature. Effects of ion implantation on the optical properties of polymers were investigated using Ultraviolet-Visible (UV-Vis) spectroscopy. Comparative Rutherford Backscattering Spectroscopy (RBS) analysis confirmed the implanted ion doses and increase in carbon concentration in the polymers. Ion implantation induced loss of hydrogen in the near surface of the polymers has been observed using Time of Flight-ERDA. The analysis efficacy of and ion beam induced damages due to Au⁷⁺ and Cu⁵⁺ beams have been investigated comparatively. UV-Vis analysis shows an increase in absorption intensity and a decrease in optical energy band gap as the ion fluence increases. The observed changes in UV-Vis have been correlated with RBS and Time of Flight-ERDA results. Possible ways of minimizing beam induced damage while improving efficacy of the analysis have been suggested.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

Msc

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