TEM observation of latent tracks of heavy ions in semi-crystalline polymers

Vetter J, Michler GH, Naumann I
RADIATION EFFECTS AND DEFECTS IN SOLIDS 143 (1998) 273-286

When high-energetic ions pass a solid they can induce damage in the material structure by deposition of a huge amount of energy along their paths. Depending upon the kind of material these so-called latent tracks can be etched by suitable etchants. In this work latent tracks in polymers are investigated for the first time by transmission electron microscopy (TEM). Bulk polymeric material and thin sections of HDPE, LDPE, LLDPE and PP, prepared by cryo-ultramicrotomy were irradiated with high-energetic ions (U, Xe, Zn) and after chemical staining investigated by TEM. The cross sections of the ion tracks appear as circularly shaped spots in the amorphous regions with diameters of about 3-8 nm. The mean track diameter increases with the atomic number of the ions. Inside the crystalline lamellae the tracks are elliptically shaped with the long axis in parallel orientation to the extended macromolecules (c-axis). This result indicates breaking and relaxation of macromolecular segments inside the lamellae.