

Highly conductive ion tracks in tetrahedral amorphous carbon by irradiation with 30MeV C₆₀ projectiles

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Electrically conducting ion tracks are produced when high-energy heavy ions pass through a layer of tetrahedral amorphous carbon (ta-C). The tracks are embedded in the insulating ta-C matrix and have a diameter of about 8 nm. Earlier studies showed that the electrical currents through individual tracks produced with Au and U projectiles exhibit rather large track-to-track fluctuations. In striking contrast, 30MeV C₆₀ cluster ions are shown to generate conducting tracks of very narrow conductivity distributions. Their current versus voltage curves are linear at room temperature. We also investigated ta-C films doped with B, N, Cu and Fe at a concentration of 1 or 2 at.%. In particular, Cu- and Fe-doped samples show increased ion track conductivity.