Conducting ion tracks in diamond-like carbon films.

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Electrically conducting thin filaments were produced in diamond-like carbon (DLC) films by heavy ion irradiation. For this purpose, 1 GeV uranium ions were chosen since they provide the largest electronic stopping power (dE/dx) possible and therefore lead to the highest temperature in the tracks. Due to the high temperature a transformation of the insulating, diamond-like form of carbon (sp^3-bonding) into the conducting, graphitic configuration (sp^2-bonding) occurs. The separation of the tracks from one another is determined by the ion beam fluence while their length is determined by the thickness of the film. Atomic force microscopy (AFM) was used to measure the topography and current mapping of the irradiated films. Hillocks of approximately 4 nm height and conducting channels with a current enhancement of 3 to 4 orders of magnitude were found at the ion impact sites. The resistivity of the ion tracks is in the range of 40 to 250 Ωcm.