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Correlation between Absorption Edges and Electrical Conductivity in Ion Irradiated Hydrogenated Amorphous CarbonsG. Compagnini¹, U. Zammit², K.N. Madhusoodanan² and G. Foti³¹Istituto Nazionale di Fisica della Materia, Corso Italia 57-95129 Catania, Italy²Dipartimento di Ingegneria Meccanica, II Università di Roma 'Tor Vergata' Via della Ricerca Scientifica e Tecnologica 00133 Roma, Italy³Dipartimento di Fisica - Università di Catania - Corso Italia 57-95129 Catania, Italy

The effect of ion irradiation on the optical and electrical properties of hydrogenated amorphous carbons were investigated by using a Photothermal Deflection Spectroscopy technique and conventional resistivity measurements. It was found that the well known hydrogen desorption induced by ion beam irradiation causes an overall increase of order in the films leading to a sharpening of the band edge slope in agreement with the tendency of trigonal carbon to clusterize in ordered graphitic domains. Correspondingly it was observed a decrease of the optical energy gap from 1.6 to 0.2 eV due to the formation of weakly bonded π electron states. The room temperature resistivity of the films changes by about 10 orders of magnitude from the value of the as prepared sample ($\rho \approx 10^{10} \Omega\text{-cm}$), to $\rho \approx 1 \Omega\text{-cm}$ at ion fluences of 10^{17} ions/cm². Moreover the observed temperature dependence of $\rho(T)$ can be interpreted with charge transport due to hopping between isolated, conducting islands and the results are discussed in terms of the extension of sp²-hybridised areas in the amorphous network.