

Low-temperature positron annihilation study of B⁺-ion implanted PMMA

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Abstract

Temperature dependent positron annihilation lifetime spectroscopy (PALS) measurements in the range of 50-300 K are carried out to study positronium formation in 40 keV B⁺-ion implanted polymethylmethacrylate(B:PMMA) with two ion doses of $3.13 \cdot 10^{15}$ and $3.75 \cdot 10^{16}$ ions/cm². The investigated samples show the various temperature trends of ortho-positronium (o-Ps) lifetime τ_3 and intensity I₃ in PMMA before and after ion implantation. Two transitions in the vicinity of ~ 150 and ~ 250 K, ascribed to γ and β transitions, respectively, are observed in the PMMA and B:PMMA samples in consistent with reference data for pristine sample. The obtained results are compared with room temperature PALS study of PMMA with different molecular weight (Mw) which known from literature. It is found that B⁺-ion implantation leads to decreasing Mw in PMMA at lower ion dose. At higher ion dose the local destruction of polymeric structure follows to broadening of lifetime distribution (hole size distribution). © T.S. Kavetskiy, V.M. Tsmots, S.Ya. Voloshanska, O. Šauša, V.I. Nuzhdin, V.F. Valeev, Y.N. Osin, and A.L. Stepanov, 2014.

Keywords

Ion implantation, Molecular weight, Polymethylmethacrylate, Positron annihilation lifetime spectroscopy, Positronium