Abstract

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Gamma rays interaction with copper doped lithium phosphate glasses

Undoped and copper-doped lithium phosphate glasses were prepared. CuO-doped glasses possess characteristic greenish color which deepens with the increase of CuO content. Experimental optical absorption spectra of the undoped lithium phosphate glasses reveal strong ultraviolet absorption bands and no visible bands are observed. These strong UV bands are assumed to originate from unavoidable trace iron ions contamination within the chemicals used for the preparation of the glass. The optical absorption spectra of the CuO-doped phosphate glasses reveal the same UV absorption as observed in the undoped samples beside an extra broad visible absorption band which splits to some component peaks. Such visible spectra are related to the presence of divalent copper (Cu$^{2+}$) ions in distorted octahedral coordination. Gamma irradiation of the undoped sample produces induced defects generated through the liberation of pairs of electrons and positive holes. CuO-doped glasses show some shielding behavior towards successive gamma irradiation especially at high CuO contents. FTIR absorption spectra of the studied glasses indicate the appearance of characteristic vibrational bands due to phosphate groups. Gamma irradiation causes minor effects on the FTIR spectra, but the bands due to water molecules are strongly affected by gamma irradiation because of loose bonding within the glass network.