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EPR Characterization of Gamma-Irradiated Xerogels

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Silicate glass was considered as suitable material for dosimetric purposes, and the study of stable paramagnetic centers induced by radiation has proven its potential for radiation dosimetry. Despite its several advantages that make it especially attractive, silicate presents some disadvantages like heterogeneity of chemical composition and high melting temperature. These problems can be resolved by elaboration of silica glass at room temperature via sol-gel method, which was an excellent and economically process offering purity, homogeneity besides to control components and properties of this material.
In this study, the sol gel process preparation starts from a solution containing tetraethoxysilane (TEOS) precursor and consist mainly on two steps, hydrolysis and polycondensation. Hence, the sol to rigid glass conversion took place after loss of solvent, with drying gels at room temperatures and then gamma irradiated in order to induce paramagnetic centers. Therefore, we report in this study, the paramagnetic states induced after irradiation in iron doped and pure SiO2 sol-gel glasses.
The aim of the present work is to investigate the EPR properties of sol-gel silica glass and to ascertain its possible use for high dose dosimetry.
The EPR spectra of unirradiated silica, recorded at room temperature and at 140 K exhibit a silent spectrum. However, major changes occur in the spectrums of gamma irradiated samples are attributed to the formation of non-bridging oxygen hole centers and E'centers. The spectrum of iron doped silica recorded at 140 K consists of four resonances : g=4,3 attributed to ion Fe3+ , g=8,27 and g=2,73 associated to presence of iron clusters in pores, finally g=1,99 may be due to defects of irradiation in sol-gel material.
The preliminary EPR analysis of radiation induced paramagnetic centers in sol-gel silica represents a relevant approach to dosimetry. According to the current results, complementary AFM and FTIR studies are in progress.

Country/Organization invited to participate

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