TRANSFER OF EXCITATIONS BETWEEN THE OPTICAL CENTRES OF Ce DOPED SILICA GEL - GLASSES

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The purpose of present work is a spectral-luminescent investigation of energy transfer from intrinsic defects of matrix to optical centers of cerium as well as between the Ce ions in silica gel-glasses. It has been found that cerium ions form two types of optical centers. It is assumed that they represent the Ce(III) oxocomplexes having in their nearest surroundings the four-charge (the first type) and three-charge (the second type) ions of cerium together with Si ions. We have observed a significant enhancement of Ce(III) luminescence quantum yield for vacuum-vitrified glasses with low cerium concentration. For similar glasses vitrified in air this enhancement was several times higher. This effect may be due to the excitation energy transfer from the Ce(IV) charge transfer state or from the photoreduced central ions of these oxycomplexes to Ce(III) ions caused by resonance and superexchange interaction, respectively. The similarity of the excitation spectrum of the Ce-containing glasses to the absorption spectrum of Ce(III) permits us to conclude that the efficiency of these interactions is proportional to the overlap integral of homogeneously broadened donor and acceptor spectra at the excited transition.The luminescence quantum yield of glasses at medium and high concentration of activator is determined by screening and quenching effects of new forms absorbing at 290 nm.The concentration quenching of luminescence resulting from interion interaction is weak. An influence of activator charge state and structure of activator centers on reorganization of intrinsic defect of matrix has been discussed. In particular it has been demonstrated that the four-charge cerium ions entry into the matrix without essential disturbance of gel-glass structure.