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NATURE OF ACTIVATOR RADIOLUMINESCENCE IN LiF(W) CRYSTAL

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In the interval of 105-800 nm wavelengths one has investigated luminescent and absorption, and in temperature interval of 77-350 K thermoluminescent characteristics of scintillation LiF(W) single crystals in which the activator is polyatomic quasi-molecule. Quasi-molecule structure has been investigated by ESR method.

It has been shown that radioluminescence (RL) spectrum maximum falls at 430 nm. Absorption spectra are characterized by additional absorption bands in the region of 110-120 nm, 140 and 180-190 nm, the ratio between which is determined be crystal growth conditions. Intensity of 180-190 nm band is proportional to activator concentration. At this band photoluminescence (PL) excites and the spectrum of this luminescence coincides with RL. Spectrum of PL excitation coincides with activator absorption band Decay time of PL coincides decay time of slow scintillation component. The obtained results indicate that RL of LiF(W) crystal conditioned by intrinsic transition in activator quasi-molecule (Seitz model of activation).

Concentration and azimuthal dependencies of ESR spectrum have been investigated after gamma-irradiation. It has been shown that the activator is metal-oxygen complex of cubic symmetry in which tungsten ion is surrounded by 4 oxygen ions. Charge compensating cation vacancy is in the second coordination sphere of W-ion. The thermoluminescence (TL) curve is characterized by peak at 138K only which is conditioned by thermal delocalization of V_k-centers. The presence of the hole peak only on TL curve allows to suggest the mechanism of activator radioluminescence. Hole recombination on the electron captured by the activator will lead to excitation of the letter owing to hole-electron recombination. The hole recombination on electron colour centers will lead to exciton luminescence excitation and the activator will excite owing to reabsorption. Thus, activator RL, defining spectrum of scintillator luminescence, is conditioned by the process of hole-electron recombination.