"PHOTOSENSITIVE HETEROSTRUCTURE – CHALCOGENIDE SCINTILLATOR" DETECTORS OF IONIZING RADIATION BASED ON $A^{II}B^{VI}$ COMPOUNDS

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Development of scintillators based on semiconductor compounds $A^{II}B^{VI}$ has allowed to efficiently filling the empty gap in the "scintillator-photodiode" detector family for modern radiation introscopes. In fact, scintillators based on isovalently doped ZnSe crystals have conversion efficiency 4–7 % higher, and radiation stability – more than 10^3-10^4 times higher than CsI(Tl). From the other side, it is known that certain complex structures based on broad-gap $A^{II}B^{VI}$ compounds display high photosensitivity in the visible range, corresponding to the luminescence maximum of ZnSe(Te) crystals (λ_{max} = 600–640 nm). Accounting for unique combination of properties – ZnSe(Te) crystals are both semiconductor materials and highly efficient scintillators – it seemed possible to obtain photosensitive structures based on $A^{II}B^{VI}$ compounds directly on the surface of the semiconductor scintillator.

Methods of preparation of photosensitive structures *n*ZnSe(Te)–*p*ZnTe and ZnSe(Te)/*p*ZnTe–*n*CdSe using solid-phase substitution reactions and subsequent epitaxial growth on crystals ZnSe(Te) are considered.

Luminescence spectra of the scintillator and photosensitivity of the structure *n*ZnSe(Te)–*p*ZnTe are only weakly overlapping, and the spectral concordance factor does not exceed 0.3. However, due to high level of light collection in ZnSe(Te)–ZnTe detectors, their X-ray sensitivity reaches 50 nA·min/R·cm^2, which is comparable to parameters of "scintillator – Si-photodiode" detectors. The shape of the spectral characteristic of ZnSe(Te)/*p*ZnTe–*n*CdSe structure depends upon concentration n_e in the CdSe layer. When n_e is increased from $3.6\times10^{\text{[illegible]}}$ cm^{-3} to 2.4×10^{17} cm^{-3}, the spectral concordance factor rises from 0.62 to 0.98.

It has been shown that maximum e.m.f. value for integrated detectors is 1.2-1.4 V, and their X-ray sensitivity reaches values up to 150-200 nA·min/R·cm^2. Dynamic linearity range of output characteristics of the detectors was not less than 10^5, afterglow level after 20 ms – less than 0.05 %.

Thus, it can be concluded that, as for the full set of their output and functional characteristics, integrated detectors ZnSe(Te)–ZnTe and ZnSe(Te)/ZnTe–CdSe can be successfully used instead of conventional "scintillator – Si-photodiode" detectors in X-ray tomographs and dosimetric equipment.

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