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Functional characteristics of composite scintillators based on Me+ doped ZnWO4 micropowders

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The developing of more technological and less expensive methods of obtaining materials with controlled functional parameters is an actual task of scintillation materials science. Significant prospects in this direction are opened in the creation of composite materials based on microcrystalline scintillation powders, which have a number of advantages in comparison with single crystals, such as more simple technology, high homogeneity of scintillation parameters thought the area and absence of linear dimensions restriction. Zinc tungstate is characterized by a large effective atomic number and high density, which allows it to be used at high energies and makes it attractive for creative of composite scintillators based on it.
It was shown [1] that the light output of the composite scintillator based on ZnWO4 micropowder obtained by solid-state synthesis with the addition of mineralizer (0.1 wt.% LiNO3) is at the level of that for the composite of grinding ZnWO4 crystal. This value exceeds the value for the ZnWO4 single crystal in 14%. However, this material is characterized by a high level of afterglow (0.361% in 3 ms after irradiation), which does not allow to offer it for use in digital radiography systems.
Therefore, the aim of this work is to develop technological approaches to obtaining luminescent microcrystalline ZnWO4 powder with improved scintillation characteristics by solid-state synthesis.
Cation doping is one of the traditional and quite common methods of controlling the scintillation characteristics of materials. The effect of cations (Li+, Rb+, Cs+), which differently incorporate into the ZnWO4 lattice and deform the emission centers, on the luminescent characteristics of the synthesized powders was investigated. The concentration of adding impurities in the reacting mixture of ZnO and WO3 was 0.3 mol.%. The maximum intensity was observed for samples doped by Rb+ and Cs+, the values of witch almost in two times exceed the value for ZnWO4 single crystal.
The concentration dependence of scintillation characteristics of synthesized powders was investigated in range 0.001 to 0.02 mol.%. Composite samples were prepared for this studies consist of ZnWO4 micropowder and a silicon rubber.
The composites based on powders synthesized with the addition of 0.01 mol.% Rb2SO4 demonstrates the light output at the level of the sample from the ground single crystal, and the afterglow level in the millisecond range is an order of magnitude lower than for the single crystal sample, which makes the obtained material promising for use in computed tomography.

1. Flexible composite scintillator based on ZnWO4 micro- and nanopowders / V.S. Tinkova, A.G. Yakubovskaya, I.A. Tupitsyna, S.I. Abashin, A.N. Puzan, S.O. Tretyak // Technologiya I konstruirovanie v elektronnoi apparature: Materials of electronics. –№ 1-2. –2019. –P. 40-49.

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