STUDY OF X-RAY PHOSPHORS USED FOR THE VISUALIZATION OF IONIZING RADIATION

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There is considerable interest in Ukraine after Chernobyl accident in dosimetric X-ray luminescent materials which can convert the energy of ionising radiation into the visible emission.

A special request is for X-ray luminophors for high-dose and high-temperature conditions.

The main requirements which X-ray phosphors have to satisfy for the visualization purposes are:

i) high converting efficiency (high intensity of visible emission);

ii) radiation stability (preserving the luminescent properties under the high-dose and high-energy radiation)

The aim of the study is - to test the feasibility of application of X ray phosphors currently used under irradiation of soft X-ray (in X-ray screens in medicine) for high-energy, high-dose and high-temperature conditions.

Materials - solid powders of europium-doped X-ray phosphors.

Techniques - 1) steady-state X-ray luminescence. For luminescence excitation X-ray, γ- and β- radiation in the range of energy from 40 keV to 5 MeV were used.

2) time-resolved laser-induced photoluminescence (λ-excitation 337 nm). On the basis of the luminescence decay measurments the life-times were calculated

The main results obtained in the study (summarized in the table) are the following:

№	Composition of samples	Visible emission, λ nm	life-time, τ	luminescent center
1	BaFCl·Eu	390	6.3 μs	Eu^{2+}
2	$Sr_3(PO_4)_2$·Eu	410	32 ns	Eu^{2+}
3	Y_2O_2S·Eu	585	67.2 ns	Eu^{3+} cluster
4	Y_2O_3·Eu	400	10.2 μs	Eu^{3+}
		630	~4000 μs	

i) all tested phosphors under high-energy excitation revealed the bright visible emission in blue-green and yellow-red region

ii) luminescent properties are preserved after high-dose (300 Gy) irradiation and high-temperature annealing (300 C°) of samples.

The next important feature of tested phosphors is that in most cases the spectral shape of radioluminescence is practically the same as for laser-induced luminescence.

For the BaFCl·Eu and for $Sr_3(PO_4)_2$·Eu the luminescence consists of mono-band emission and can be attributed for Eu^{2+}.

Spectrum of Y_2O_3·Eu contains two luminescent species - mono-band emitting near 400 nm and the second one with fine-structure centered near 630 nm. The last spectrum consists of f-f transitions characteristic for Eu^{3+}. It must be noticed that these two luminescent species have also considerably different life-times.

The influence of the host solid-matrices on the life-time of the luminescent species will be discussed.