

Measurement of the luminescence properties of $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ powder scintillators under X-ray radiation.

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Streszczenie

The aim of the present study was to investigate the absolute luminescence efficiency of gadolinium oxysulfide powder scintillators, doped with praseodymium, cerium and fluorine ($\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$). $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ is a non-hygroscopic material, emitting green light with short decay time. For the purposes of this study, two scintillating screens with coating thicknesses 35.7 and 71.2 mg/cm^2 , were prepared in our laboratory from $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ powder (Phosphor Technology, Ltd) by sedimentation on silica substrates. The light emitted by the phosphors under investigation was evaluated by performing measurements of the absolute efficiency under X-ray exposure conditions with tube voltages ranging from 50 to 130 kV. Results were compared with previously published data for $\text{Gd}_2\text{O}_2\text{S}:\text{Eu}$ screens. The spectral compatibility of $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ with various existing optical detectors, was investigated after emission spectra measurements. Particle size and morphology parameters of the $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ powder phosphor were verified via scanning electron microscope (SEM) micrographs. Absolute efficiency was found to maximize at 60 kVp for the 71.2 mg/cm^2 and at 90 kVp for the 35.7 mg/cm^2 $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ screens. Absolute efficiency of the 71.2 mg/cm^2 $\text{Gd}_2\text{O}_2\text{S}:\text{Pr,Ce,F}$ screen was higher in the whole X-ray tube voltage range showing potential interest for non-CT medical imaging (i.e. dental radiology) or industrial digital radiography.

Słowa kluczowe

Inorganic scintillators, Radiation detectors, $\text{Gd}_2\text{O}_2\text{S}:\text{Pr, Ce, F}$

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