

Preparation and imaging performance of nanoparticulated $\text{LuPO}_4\text{:Eu}$ semitransparent films under X-ray radiation.

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Streszczenie

The aim of the present work was to demonstrate the fabrication technique for semitransparent layers of nanoparticulated (~ 50 nm) $\text{LuPO}_4\text{:15\%Eu}$ phosphors. Furthermore, to present their basic luminescent properties and provide results regarding their performance in a planar imaging system incorporating a CMOS photodetector. Parameters such as the Detective Quantum Efficiency (DQE), the Normalized Noise Power Spectrum (NNPS) and the Modulation Transfer Function (MTF), were investigated. The NNPS was found to present significantly higher values near the zero frequency for the $67\text{ }\mu\text{m}$, $100\text{ }\mu\text{m}$ films, pointing on their higher non uniformities compared to the 220 and $460\text{ }\mu\text{m}$ films. For the two thickest films ($460\text{ }\mu\text{m}$ and $220\text{ }\mu\text{m}$) the MTF curves practically do not differ, while MTFs for the thinner layers of $100\text{ }\mu\text{m}$ and $67\text{ }\mu\text{m}$ are higher as the layer's thickness decreases. The higher DQE values observed for the $220\text{ }\mu\text{m}$ and $460\text{ }\mu\text{m}$ films up to medium frequencies, while at high frequencies the DQE values are comparable. Although the MTF values of these films are much lower than the thinner screens, the capability of the higher x-ray absorption, in conjunction with the low noise properties, lead to higher DQE values.

The $\text{LuPO}_4\text{:Eu}$ semitransparent films seems to be a very promising scintillator for stationary x-ray imaging. The acquired data allow to predict that high-temperature sintering of our films under pressure may help to improve their imaging quality, since such a processing should increase the luminescence efficiency without significant growth of the grains, and thus without sacrificing their translucent character.

Słowa kluczowe

$\text{LuPO}_4\text{:Eu}$, Semitransparent films, Nanophosphor, X-rays imaging

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