

Light emission efficiency and imaging performance of $\text{Lu}_2\text{O}_3:\text{Eu}$ nanophosphor under X-ray radiography conditions: comparison with $\text{Gd}_2\text{O}_2\text{S}:\text{Eu}$.

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Streszczenie

Nanocrystalline europium-activated lutetium oxide ($\text{Lu}_2\text{O}_3:\text{Eu}$) is a strong candidate for use in digital medical imaging applications, due to its spectroscopic and structural properties. The aim of the present study was to investigate the imaging and efficiency properties of a 33.3 mg/cm^2 $\text{Lu}_2\text{O}_3:\text{Eu}$ scintillating screen coupled to a high resolution RadEye HR CMOS photodetector under radiographic imaging conditions. Since $\text{Lu}_2\text{O}_3:\text{Eu}$ emits light in the red wavelength range, the light emission efficiency and the imaging performance were compared with results for a $\text{Gd}_2\text{O}_2\text{S}:\text{Eu}$ phosphor screen. Parameters such as the Absolute Efficiency (AE), the X-ray Luminescence Efficiency (XLE), and the Detector Quantum Gain (DQG), were investigated. The imaging characteristics of $\text{Lu}_2\text{O}_3:\text{Eu}$ nanophosphor screen were investigated in terms of the Modulation Transfer Function (MTF), the Normalized Noise Power Spectrum (NNPS) and the Detective Quantum Efficiency (DQE). It was found that $\text{Lu}_2\text{O}_3:\text{Eu}$ nanophosphor has higher AE and XLE by a factor of 1.32 and 1.37 on average, respectively, in the whole radiographic energy range in comparison with the $\text{Gd}_2\text{O}_2\text{S}:\text{Eu}$ screen. DQG was also found higher in the energy range from 50 kVp to 100 kVp and comparable thereafter. The imaging quality of $\text{Lu}_2\text{O}_3:\text{Eu}$ nanophosphor coupled to the CMOS sensor was found to outmatch in any aspect in comparison with the $\text{Gd}_2\text{O}_2\text{S}:\text{Eu}$ screen. These results indicate that $\text{Lu}_2\text{O}_3:\text{Eu}$ nanophosphor could be considered for further research in order to be used in medical imaging applications.

Słowa kluczowe

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