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Influence of surface roughness on the light transmission through the boundaries of luminescent materials in radiation detectors*

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The optical transfer properties of an imaging system are affected by the performance of the discrete cascaded system stages that transfer efficiently the optical signal. Apart from the contribution of each component to the overall optical propagation, crucial role also plays the intermediate surface conditions. Surface roughness is characterized by irregularities with respect with the ideal smooth form. The degree of roughness has an influence on the surface behavior affecting correspondingly the overall enhancement of system's optical performance. In this manuscript, the angle dependent effect of surface roughness on phosphor . optical materials configuration is provided taking into account eight luminescent materials (CsI, $Y_3Al_5O_{12}$, Y_2O_3 , $Bi_4Ge_3O_{12}$, $CaWO_4$, ZnS, Lu_2O_3 and Gd_2O_2S) and three optical materials (InGaAs, ITO and SiO_2). Results showed that higher transmission optical properties exhibited the: (i) CsI–InGaAs combination, (ii) ZnS–ITO and (iii) ZnS– SiO_2 combination. The transmission factor was also quantitatively affected by increasing the surface roughness values and by decreasing the incident polar angles.

Keywords: luminescent materials, optical sensors, surface roughness.

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