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Light Yield Enhancement of the 157-Gadolinium Oxysulfide Scintillator Screens for the High-resolution Neutron Imaging

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LIGHT YIELD ENHANCEMENT OF THE 157-GADOLINIUM OXYSULFIDE SCINTILLATOR SCREENS FOR THE HIGH-RESOLUTION NEUTRON IMAGING

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The work presented here follows upon the recent enhancement of Gadox (Gd2O2S:Tb3+) scintillator screen within the Neutron Microscope project [1] at Neutron Imaging and Activation Group (NIAG) of the Paul Scherrer Insitut (PSI). Recently, highly enriched gadolinium (enriched in Gd-157 isotope) of Gadox phosphor powder [2] was utilized for the enhancement of the neutron absorption. This allowed for a significant reduction of scintillator layer thickness and thus led to the corresponding improvement of the spatial resolution of the neutron imaging setup [3].
Here we present the first attempts on micro/nanostructuring of the high-resolution neutron-sensitive scintillator substrates using atomic layer deposition (ALD). For this purpose, iridium layers of different thicknesses were deposited by ALD onto silicon substrates. The application of the iridium layers resulted in an increase of the light output up to 60 % in comparison with the uncoated silicon substrates. This increase in the light yield can be attributed to both the higher reflectance of the substrate and the enhanced back-scatter of the conversion electrons off the high density layer of the deposited iridium. The decrease in the spatial resolution of the Ir-deposited scintillator screen was found to be rather minor. The results are supported by Monte Carlo simulations. The outlook of the future steps regarding micro/nanostructuring of the neutron-sensitive scintillators will be presented.

References

[1] P. Trtik, J. Hovind, C. Grünzweig, A. Bollhalder, V. Thominet, C. David, A. Kaestner and E. H. Lehmann, "Improving the Spatial Resolution of Neutron Imaging at Paul Scherrer Institut - The Neutron Microscope Project,"Phys. Proc., vol. 69, 2015.
[2] P. Trtik and E. H. Lehmann, "Isotopically-enriched gadolinium-157 oxysulfide scintillator for the high-resolution neutron imaging,"Nucl. Instr. Meth. Phys. Res., vol. 788, 2015.
[3] P. Trtik and E. H. Lehmann, "Progress in High-resolution Neutron Imaging at the Paul Scherrer Institut - The Neutron Microscope Project", J. Phys. - Conf. Series, vol. 746, 2017

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