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R&D plastic scintillator with pulse shape discrimination capability

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The work reports result of studies conducted to improve scintillation performance of plastic scintillators (PS) capable of neutron/gamma pulse-shape discrimination. A research group led by Zaitseva from LLNL made a major contribution to the field of development such materials. However, despite the accumulated experience of material production, there is a demand to modify their composition in order to improve their optical, scintillation and mechanical characteristics. Commercial products with good scintillation properties (EJ276D) are currently difficult to purchase. In this regard, the creation of domestic, commercially available analogues is relevant for solving problems in fundamental and applied physics. In this work, methods for obtaining plastic scintillators with PSD capability were reproduced. Poly(styrene-co-divinylbenzene) was used as the scintillation base and 2,5-diphenyloxazole, para-terphenyl, a mixture of diisopropylnaphthalene isomers and diphenyl were used as fluors. The light yield, transparency, figure of merit and hardness of the obtained PS samples were measured. The best performance for a sample with the composition 40% PPO, 0.2% POPOP, 7.5% DVB was achieved. The light yield was 1.12 ± 0.05 , the transmittance coefficient (optical path length 1 cm) at a wavelength of 430 nm was 0.72 ± 0.02 , the figure of merit for n/ γ pulse shape discrimination was 3.65 ± 0.13 , and the Shore D hardness was 48 ± 2 . The obtained results are compared with the EJ276D sample and literature data.

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