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Study of the scintillation properties of pure and yttrium-doped BaF2 crystals

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BaF2 scintillator crystals are considered as candidates for use in the electromagnetic calorimeter of the second phase of the Mu2e experiment. The key advantage of this scintillator is its high radiation stability and a fast emission component with a short decay time of 0.6-0.8 ns in the 190-250 nm range, which would significantly improve the speed and time resolution of the calorimeter. However, the high emission level of the slow component can significantly reduce the possibility of using BaF2 crystals at high beam intensities. Various methods are used to separate or suppress the slow component, including doping of BaF2 crystals with rare earth metals, such as Y, La, Ce.

In this work we present study of scintillation properties of pure and yttrium-doped BaF2:Y crystals (1, 3, 5 at.% of Y) with dimensions of 10 × 10 × 10 mm. The scintillation properties of the samples before and after irradiation at the IBR-2 reactor are compared. Studies show the suppression of the slow emission component of yttrium-doped BaF2 crystals, as well as a change in the radiation hardness of yttrium-doped irradiated samples.

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