Influence of optical properties selectivity and surface condition of CsI crystals on scintillation parameters

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At present, pure CsI is widely used as material for fast scintillators. The nuclear physics is one of main areas where such detectors find application. The main requirements to those are large scintillating volume and low intensity of the slow emission component characterized by F/T parameter, i. e. ratio of light sums of a scintillation pulse emitted during first 100 ns and 1000 ns. High F/T values allow to ensure reliable timing selection of events associated with various nuclear transitions. Meeting each of specified demands is a difficult technical problem. It is bound to the unwelcome circumstance that the presence of Na^+, Tl^+, CO_3^{--} and other uncontrollable impurities in CsI crystals due to their presence in initial raw material causes an attenuation of the fast UV-emission (τ=5-10 ns, λ_{max}=300 nm) and long afterglow in visible range with characteristic times $\tau > 1$ μs [1,2]. Scintillation light absorbtion acquire selective character. UV-component attenuation length is shorter than that for the visible component. As a result F/T declines along with average light path increasing which is inevitable with large scintillating volumes and complicated shapes. A method to improve F/T based on spectrum shifting coatings is proposed. A thin film containing luminophor applied onto lateral surface of the scintillator absorbs intrinsic emission and reemits in longer wavelengths where CsI possesses a higher transparency. We tested this method on truncated hexagonal pyramids with height 220 mm and base width 70 mm. The crystals of mean quality coated with such a composition improve their F/T by 7%. Light output increases simultaneously (~150% of primary value).

[1] A.N. Belsky, A.N. Vasil'ev, A.V. Gektin, Preprint ISC-91-3. Kharkov, 1991

[2] A.N. Belsky, A.N. Vasil'ev, A.V. Gektin, Preprint ISC-90-26. Kharkov, 1990