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Scintillation properties of high-resolution La(BrxCl1-x)3:Ce and high-sensitivity CeBr3 crystals

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Scintillation materials based on halide-lanthanide matrix elements are described in terms of material properties and applications. A new embodiment in this group of scintillators is presented, where the matrix material contains a mixture of two halides, namely lanthanum bromide and lanthanum chloride, that form a solid solution in the uranium tri-chloride lattice type. The matrix material also includes cerium as the activator. The scintillation properties of the new La(BrxCl1-x)3:Ce material are discussed and compared with those of CeBr3. We report on several aspects relevant to gamma-ray spectrometry, such as scintillation characteristics, energy resolution, intrinsic activity, decay time, non-proportionality of the response, and gamma-ray detection performance up to 3 MeV.

The unique advantages of each material are discussed in the context of specific detector requirements for high energy resolution and/or high detection sensitivity. The presence of 138La and 227Ac in these scintillators poses a limitation to their usage in low-intensity gamma-ray spectrometry, in particular for homeland security and environmental applications, which must rely on high detection sensitivity. Thanks to drastically reduced intrinsic activity, CeBr3 holds significant merit in ultra-high sensitivity detection when detection time is critical. The ability to detect signals and to distinguish peaks of nearly the same energy will be discussed for specific energy ranges and specific isotopes, including, for example, the detection of 40K and its interference with 138La.

Has accepted

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