Material optimization study of $GdAlO_3$:Ce for scintillation applications

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Scintillation materials are used for the conversion of high energy particles energy to UV/VIS light in detection systems. One of commercially used scintillators is the $YAlO_3$:Ce^{3+} perovskite (YAP:Ce) produced as a single crystal. YAP:Ce has suitable properties for its application in electron microscopy, gamma spectroscopy, X-ray and gamma counting and X-ray imaging screens. On the base of commercial success of YAP:Ce, other aluminate materials with the perovskite structure were studied with the aim to find a material with better scintillation properties. One of studied materials is cerium-doped gadolinium aluminium perovskite $GdAlO_3$:Ce (GAP:Ce). It exhibits higher density and effective atomic number compared to YAP:Ce. However, its light yield is lower than expected for this material and its scintillation kinetics contains slow components. These unwanted properties come from the energy transfer between gadolinium and cerium.

This work pursues a new approach to improve the scintillation properties of this material. Ceramic pellets of gadolinium aluminium perovskite doped with cerium and admixed with lanthanum ((Gd,La)AlO_3:Ce) were prepared using co-precipitation method. The effect of cerium and lanthanum content was studied using radioluminescence and photoluminescence spectroscopies. An improvement of scintillation properties (emission intensity and decay kinetics), in comparison to $GdAlO_3$:Ce reported so far, was achieved.

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