

LUMINESCENCE PROPERTIES OF CERIUM, BORON AND/OR MAGNESIUM DOPED YTTRIUM AND LUTETIUM GARNETS COATINGS ON QUARTZ SUBSTRATE

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In recent years materials with luminescent properties have become very popular. In addition, these materials are very popular for usage in lamps and other light emitting devices, but nowadays scintillators and their research is becoming a very interesting subject for scientists. Scintillators are the basis for devices, that are used for radioactive contamination detection and measurement, nuclear material monitoring, also they are included in the computer detector composition of the tomography devices. There are various compounds that can be used as scintillators, but one of the most popular are those which have a garnet structure [1]. Amongst others, these can be yttrium or lutetium aluminum garnet, doped with different lanthanides (YAG:Ln; LuAG:Ln). These inorganics compounds have the required optical properties and radiation resistance [2]. The development of new scintillators is important. However, not the materials which are used are important but also their form. The preparation of powder is the simplest, but they are not suitable for the construction of scintillator detectors. Best suited and used for the manufacture of various devices are single crystals. In addition to single crystals, coatings on various pallets or microfibers can be used [3]. Due to the possibility of using different substrates, different methods of coating, materials with different properties can be prepared, which makes this method widely used. Using the sol-gel method we can obtain homogeneous multicomponent coatings at low temperature, leaving the possibility of synthesizing compounds with emission intensity [4].

Improvement of luminescence is essential for getting the fastest scintillators properties. One way to do this is to additionally dope compounds with other elements. Replacing one element with another in the crystal lattice can influence the properties of the materials. The most common goal is to improve key parameters: compound emission intensity, quantum efficiency and decay times. One of the greatest scintillators drawbacks that is being addressed is that decay time is too long. When it is extremely long, then these second signal captured by the materials overlaps with the first, making the results unreliable and provides less data than it could. Scintillators such as YAG:Ce and LuAG:Ce doped with boron or magnesium can solve this problem. If a quick quench of decay time was obtained given result would be more accurate, and this method of synthesizing scintillators could be practically applicable [5, 6].

In this work cerium boron and/or magnesium doped YAG and LuAG are synthesized on quartz substrates using sol-gel coating method. Boron and magnesium are expected to improve required luminescent properties, and with the sol-gel method, homogeneous compounds will be synthesized at low temperatures. Phosphor coatings were analyzed by x-ray diffraction (XRD) and scanning electron microscopy (SEM) and atomic force microscopy (AFM). Of course, emission, excitation spectra and decay times have been investigated as well.

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