Contribution ID: **87**

Type: **Poster presentation**

Luminescence properties of rare earth ions in novel garnets and glasses

Thursday 21 September 2017 10:18 (1 minute)

Garnet structure is a very flexible crystalline platform which allows one to control the luminescence properties by engineering the excitation transfer processes. The ease of material engineering in garnet structures allows designing materials consisting of lighter ions that are preferable for applications in high energy physics experiments in a harsh radiation environment. Meanwhile, two component glasses might be fabricated by using inexpensive and unsophisticated production processes and, thus, are attractive, first of all, for rapid prototyping of photoluminescence (PL) and scintillation properties. The amorphous glass structure makes it possible to reach high rare earth doping concentration. This leads to more efficient excitation transfer and smaller emission decay lifetime.

In this study two sets of samples were investigated. The first set consists of modified cerium doped yttrium aluminum garnets. Yttrium atoms have been partially substituted by magnesium or calcium atoms, while aluminum atoms have been partially substituted by germanium: Y2MgAlGe(AlO4)3:Ce and Y2CaAlGe(AlO4)3:Ce. The second set of samples consists of two-component silicate glasses doped with different rare earth ions. Barium, lithium, calcium and strontium silicate glasses doped with cerium, terbium, dysprosium, and europium in different combinations and concentrations were studied. The change in optical properties after transformation from glass to glass ceramics was also investigated. The samples were studied using confocal PL spectroscopy. PL spectra were measured using a spectrometer with a thermally cooled CCD camera coupled via light fiber to a WITec Alpha 300 S microscope system equipped with an objective of high numerical aperture. This setup enabled us to perform spatial mapping of PL parameters with sub-micrometer in-plane resolution. A He-Cd laser emitting at 442 nm (2.8 eV) and CW laser diode emitting at 405 nm (3 eV) were exploited for excitation. Photoluminescence excitation spectra measurements and XRD crystal structure investigation were also performed.

The study of garnet samples showed that the partial substitution of yttrium by magnesium results in a red shift of cerium ion emission, which is by 7 mm larger than that in the garnet with partial yttrium substitution by calcium. The spatially-resolved study of different aggregates in the garnet samples revealed a high degree of homogeneity of emission spectra among the different aggregates. This is an indication of high structural quality of the garnets.

The PL spectra of different glasses and glass ceramics showed that the emission spectra are insensitive to the composition of the host matrix in cerium-doped glasses, but are substantially transformed in glasses doped with europium. The emission spectra of different combinations of rare earth ions in glass matrixes of different composition have also been studied and discussed.

Has accepted

Author: VAITKEVIČIUS, Augustas (Vilnius University)

Co-authors: Mr NARGELAS, Saulius (Vilnius University); TRATSIAK, Yauhen (RI NP); Dr TRUSOVA, Ekaterina (Belarus State University, Research Institute for Nuclear Problems ,Minsk, Belarus); KORJIK, Mikhail (Byelorussian State University (BY)); Prof. TAMULAITIS, Gintautas (Vilnius University (LT))

Presenter: VAITKEVIČIUS, Augustas (Vilnius University)

Session Classification: Poster Session 3

Track Classification: P5_characterization