

STRUCTURE AND LUMINESCENCE OF YAG:CE, GD, GA CERAMICS SYNTHESIZED RADIATION ASSISTED METHOD

ZHILGILDINOV ZH. S.¹, LISITSYN V.M.², KARIPBAYEV ZH.T.¹, TULEOV A.¹,
 MUSSAKHANOV D.A.¹

¹L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan
²National Research Tomsk Polytechnic University, Tomsk, Russian Federation

YAG:Ce phosphor is the most common in the manufacture of white LEDs [1-3], materials based on YAG are used as scintillation, dosimetric, active media. They are used in the form of powders, films, ceramics, single crystals, composites. The synthesis of YAG:Ce materials of any morphology is difficult, since the formation of the main structure, yttrium aluminum garnet, is realized at temperatures above 1700 oC. Therefore, the existing technologies are constantly being improved and new technologies are being searched for.

The work shows the possibility of radiation synthesis based on YAG:Ce ceramics. Ceramic samples of various compositions were synthesized with the following charge content: Y₃Al₅O₁₂: Al₂O₃ (40%) + Y₂O₃(54) + Ce₂O₃ (1%)+ Ga₂O₃(2.5%) +Gd₂O₃ (2.5%). Synthesis was carried out by sintering samples from oxide powders in the field of high-energy electron flux. The lattice structure of synthesized samples of YAG:Ce and YAGG:Ce ceramics was compared with standards. The measured diffraction patterns are in good agreement with the standard ones.

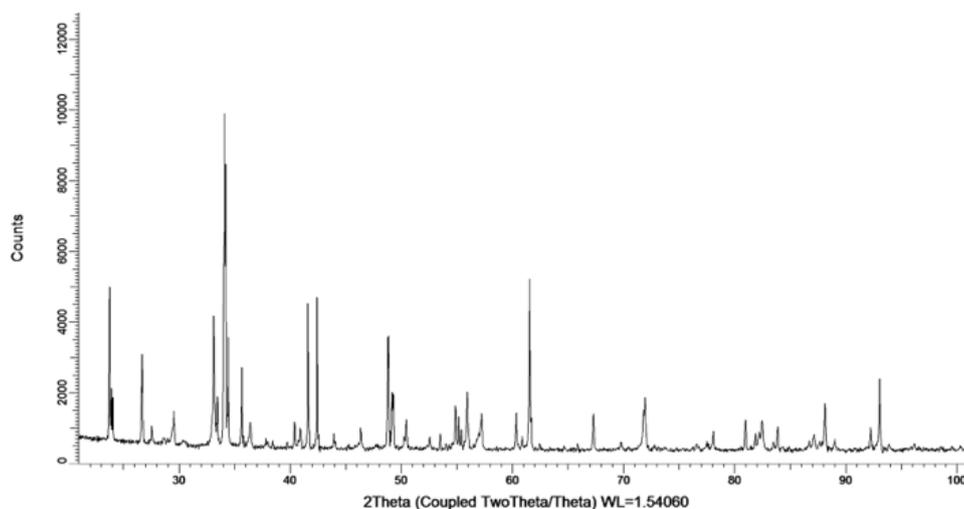


Fig. 1. X-ray diffraction pattern of synthesized YAGG:Ce ceramics

The results of studying the luminescence excitation spectra of the synthesized samples are presented. The excitation spectra of all samples exhibit two bands at 340 and ~460 nm due to ⁴F_{5/2}→⁵D₀, ⁵D₁ in Ce³⁺ activator ions. Through the action of a powerful radiation flux on the charge, it is possible to form luminescent ceramics based on YAG:Ce with characteristics similar to those known for YAG:Ce phosphors.

REFERENCES

- [1] George, N.C.; Denault, K.A.; Seshadri, R. Phosphors for solid-state white lighting. *Annu. Rev. Mater. Res.* 2013, 43, 481–501.
- [2] Narukawa, Y.; Ichikawa, M.; Sanga, D.; Sano, M.; Mukai, T. White light emitting diodes with super-high luminous efficacy. *J. Physics D - Applied Physics.* 2010, 43, 354002.
- [3] Qiao, J.; Zhao, J.; Liu, Q.; Xia, Z. Recent advances in solid-state LED phosphors with thermally stable luminescence. *J. of Rare Earths.* 2019, 37, 6, 565–572.

* The work was carried out within the framework of the grant AP08052050 of the Ministry of Education and Science of the Republic of Kazakhstan. This research was supported by Tomsk Polytechnic University CE Program.