Innovative luminescent materials for lighting and sensory applications

Oskar Bogucki[1,2], Marcin Kaczkan[1], Anna Kozłowska[2]

[1] Warsaw University of Technology, Institute of Microelectronics and Optoelectronics, Koszykowa 75, Warsaw, 00-662, Poland
[2] Łukasiewicz Research Network Institute of Microelectronics and Photonics, al. Lotników 32/46, Warsaw 02-668, Poland

Since the invention of blue light-emitting diodes, the development of LED lighting and various types of phosphor materials has been observed. Most studies concern powder phosphors embedded in resin, whose significant drawback is low resistance to high temperatures, leading to rapid degradation when operating in unfavourable conditions (e.g. during high-energy excitation). In this work, phosphor powders based on yttrium-aluminium garnet crystallites activated with rare earth ions, suspended in binders based on silica with the addition of magnesium oxide, lithium, and potassium are analysed. Such materials are characterized by good resistance to high temperatures [1,2]. A process has been developed for the synthesis of YAG powders with dopant of rare earth ions with optimal grain sizes, i.e. those that are best suspended in binders, which allows for deposition of homogeneous luminescent layers using an airbrush. Thanks to the spraying technique of applying luminescent layers, it is possible to create phosphors composed of many layers with different dopants. This significantly facilitates the manipulation of the optical parameters of the light source and the sensitivity of the temperature sensor. In this work, spectroscopic and photometric analysis of luminescent layers will be shown. In particular, emission and excitation spectra as well as chromatic coordinates will be presented. The microstructure of powders and layers made will be analysed. Exemplary application of luminescence layers as remotely illuminated phosphors using a 'blue' laser diode will be demonstrated.

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[2] S. W. Allison, D. L. Beshears, Thomas Gadfort, T. Bencic, J. Eldridge, W. A. Hollerman and P. Boudreaux. (2001), High temperature surface measurements using lifetime imaging of thermographic phosphors: Bonding tests, 19th International Congress on ICIASF 200

corresponding author: oskar.bogucki@imif.lukasiewicz.gov.pl; marcin.kaczkan@pw.edu.pl; anna.kozlowska@imif.lukasiewicz.gov.pl