**Nanocomposites and Nanomaterials**

**Local coordination in MgAl2O4:Cr nanocrystals identified by the electron paramagnetic resonance and luminescence spectroscopy**

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The improvement of optical properties of spinel-based nanostructured phosphors in comparison with single crystals can be expected [1]. The physical nature of this phenomenon is not clear until now. Since the production of single crystals is much more expensive than the making of nanostructured samples, studying the nanoparticle size effect on the electronic structure of activation centers is a reasonable problem for technological applications in optics-related fields.

To find the correlation between a local structure and luminescence properties of MgAl2O4:Cr nanocrystals we compared the luminescence in the polycrystalline samples of MgAl2O4 synthesized at 700ºC and 1000ºC by the inverse co-precipitation method with the corresponding spectra of a MgAl2O4 single crystal and a hot pressed ceramic sample. The local structure of the Cr activation centers was studied by the EPR spectroscopy. It was observed that the most intensive luminescence signal originates from the 1000ºC polycrystalline sample while the EPR signal in the same sample reduces to almost zero.

A mechanism of the luminescence and EPR spectra formation has been analyzed by the Modified Crystal Field Theory (MCFT) [2]. The method represents a new original semi-empirical approach to calculations of the electronic structure of paramagnetic ions in coordination complexes with arbitrary symmetry and numbers of ligands. Using the MCFT, g-factors and the emission intensities for the Cr ions in both octahedral [CrO6] and tetrahedral [CrO4] coordination complexes have been calculated.

1. *L. G. Jacobsohn, B. L. Bennett, R. E. Muenchausen, J. F. Smith, and D. W. Cooke*, Luminescent properties of nanophosphors, Radiat. Meas. 42 (2007) 675–678.
2. *Lamonova K.V., Orel S.M., Pashkevich Yu.G.* Modified Crystal Field Theory and its Applications, Kyiv: Akademperiodyka, 2019, — 226 pages.