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LUMINESCENCE OF COMPACTS FROM MIXTURES OF NANO AND MICRO CALCIUM FLUORIDE POWDERS

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There were carried out the studies of pulsed cathodoluminescent (PCL) and photoluminescent (PL) properties of compacts made by static (SP) and magnetic-pulse (MPP) pressing from mechanical mixtures of micro and nano calcium fluoride powders. The mixtures contained commercial powder (TU 6-09-2412-84) and nanopowder (NP) CaF_2 (NP produced by pulsed electronic evaporation at the installation NANOBEAM-2 in vacuum [1]) at powder weight ratios: 10: 0.125 -10: 1. Was shown the effect of the concentration of the CaF_2 nanoadditive, the pressing temperature and the preliminary annealing of the nanoadditive on the density of compacts. Presence of nanoparticles of Ca at NP, strong defective structure and high porosity of NP had strong impact on luminescent characteristics of the compacts made both of clean NP CaF_2 and from their mixes. Annealing of the initial NP at a temperature of 400 °C made it possible to achieve the same density of compacts of pure micropowders and nanopowders (89% of the theoretical density) using the MPP method with heating. The maximum density of compacts from mixtures of powders of different dispersity did not exceed 78% of the theoretical density. The main factor that influenced the morphology of PCL spectra of all compacts, without exception, was the compaction temperature (425 °C) in the MPP method. The blue peak (434 nm) is associated with an impurity oxygen vacuum in the nanocrystalline CaF_2 lattice and was found in the photoluminescence spectra of compacts from NP annealed at 400 ° C. The morphology of the PL spectra is more sensitive to the influence of various factors (concentration of the nanoadditive, pressing method, pressing pressure, etc.) in comparison with the morphology of the PCL spectra. Is given the study of the density and transparency of ceramics from the above compacts after annealing the compacts in vacuum at a temperature of 1000 °C.

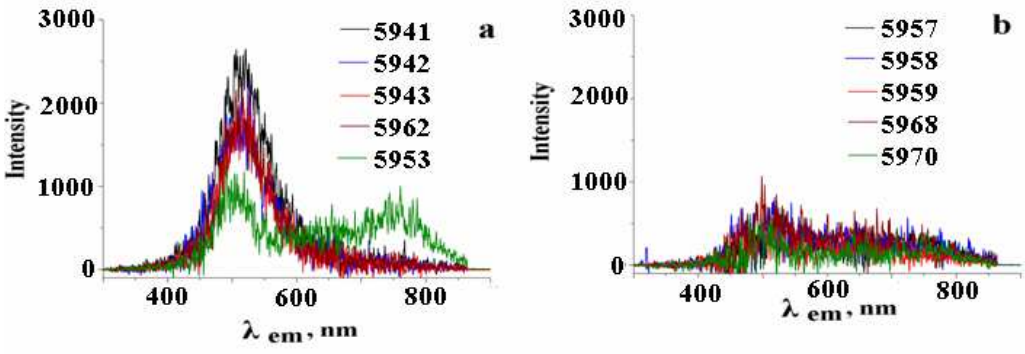

Fig.1. PCL spectra of the compacts from commercial micron powder (a) and nanopowder (b) CaF_2 . 5941-5943 и 5957-5959- static pressing, 5962, 5953 and 5968 and 5970- magnetic-pulse pressing.

REFERENCES

[1] V. G. Ilves, S. Yu. Sokovnin, M. A. Zuev, M. A. Uimin, M. Rähn, J. Kozlova, V. Sammelselg, “Effect of Annealing on Structural, Textural, Thermal, Magnetic and Luminescence Properties of Calcium Fluoride Nanoparticles,” Phys. Sol. State, vol.61 , no. 11, pp.2000-2217 , November 2019.