

SSNN 2P SYNTHESIS AND OPTICAL CHARACTERIZATION OF THE ORGANIC LUMINOPHORE NANOCOMPOSITE *PEPC/Eu(o-MBA)₃Phen*

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In last decades, research of rare-earth organic materials has been a very attractive subject to their peculiar properties and wide potential applications as luminescent labels in biological systems and active centers for luminescent materials and devices. In the work was studied nanocomposite *PEPC/Eu(o-MBA)₃Phen*, where *PEPC* – poly-N-epoxypropylcarbazol and *o-MBA* – methylbenzoic acid, *Phen* – phenanthroline. *EuCl₃·6H₂O*, *o-MBA*, and *Phen* were purchased. All reagents had analytical grade and were used without further purification. Synthesis of rare-earth complex *Eu(o-MBA)₃Phen*: a warmed ethanol solution (96%) containing 0.4 g (3 mmol) of *o*-methylbenzoic acid and 0.2 g (1 mmol) of 1,10 – phenanthroline was adjusted to pH 6.0 – 7.0 with 1M *NaOH* solution. Further, europium chloride (1 mmol) dissolved in 5 ml of water was added dropwise to the organic mixture and stirred. Light pink precipitate was formed immediately. The precipitate was filtered, washed with small portions of ethanol, dried thoroughly in air. The synthesis yield was 0.56 g (37.6%). For *C₃₆H₂₉O₆N₂*, it was calculated, %: *Eu* - 20.61, *C* - 58.63, *H* - 3.97, *N* - 3.80. Found, %: *Eu* - 20.88, *C* - 59.23, *H* - 4.17, *N* - 3.75. The thin films of nanocomposite *PEPC/Eu(o-MBA)₃Phen* were obtained on quartz substrates from colloidal solution mixed by spin-coating method and subsequently dried. The solutions of *PEPC* and *Eu(o-MBA)₃Phen* were obtained separately by dispersion in solvents by mixing toluene and *DMFA* in an ultrasonic bath for 30 min. at a temperature of 60 °C.

Nanocomposite coatings were studied separately by microscopy, optical transmission and photoluminescence spectra. The absorption threshold at different concentrations of *Eu(o-MBA)₃Phen* in *PEPC* was approximately the same (3.34 – 3.4 eV). Photoluminescence spectra were measured using monochromator based on MDR-23-24 connected to the PC, photoluminescence excitation was performed with nitrogen laser ($\lambda = 337$ nm) radiation intensity range 0.1–10³ W/cm².

PL spectra characterized the efficiency of energy transfer from the LUMO energy levels of chelates and ligands of the compound to the energetic levels of *Eu³⁺* ion. HOMO and LUMO levels of the complex *PEPC/Eu(o-MBA)₃Phen* are found to be situated between levels *S* and *T* of ligands, and this case is similar to doping of semiconductor. The photoluminescence properties can be attributed to the internal transition of *Eu³⁺* ion $^5D_0 \rightarrow ^7F_i$ ($i = 0, 1, 2, 3$ and 4), which are centered at 537, 578, 614 (611, 613, 618), 650 and 702 nm. The half width of PL band at 614 nm is less than 10 nm, which indicates that the compound *Eu(o-MBA)₃Phen* exhibits high emission and color purity. Each maximum of PL band is splitted in 3 components. A possible method of raising the fluorescence efficiency of *Eu(o-MBA)₃Phen* is the energy transfer from *S* and *T* ligands levels to internal levels of *Eu³⁺* ion. There is a rather weak and broad band at 578.5 and 614 nm associated to the $^5D_0 \rightarrow ^7F_{0,2}$ forbidden electric dipole transitions. Based on selection rules, the band at 594 nm is attributed to the $^5D_0 \rightarrow ^7F_1$ parity-allowed magnetic dipole transition, which is independent of the surroundings symmetry. The $^5D_0 \rightarrow ^7F_{1,2}$ transitions are allowed electrical-dipole transitions. The most intensive band around 614 nm belongs to the $^5D_0 \rightarrow ^7F_2$ transition that is hyper-sensitive to the symmetry of the crystal field surrounding the *Eu³⁺* ion, and will be relatively strong if the surroundings symmetry is low. In this respect, it is known that the ratio of the emission intensities $R = I(^5D_0 \rightarrow ^7F_2)/I(^5D_0 \rightarrow ^7F_1)$ is an asymmetry parameter for the *Eu³⁺* sites and a measure of the extent of *Eu³⁺* interaction with surrounding ligands, indicating on the environment of the *Eu³⁺* ion.