HIGH QUANTUM YIELD POLYMER COMPOSITE NANOMATERIAL $[Eu(\mu_2\text{-}OC_2H_5)(btfa)(NO_3)(phen)]_2 \cdot phen/PEPC$

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Lanthanide complexes possess a number of unique properties, which make them attractive for practical applications in optoelectronics. Particularly, Eu^{3+}-based complexes display strong emission upon UV or blue-light irradiation owing to the sensitization of lanthanide ions by the coordinating ligands. For various applications in optoelectronics there is a need of materials with high thermo-stability and high emission efficiency. One of possible ways to meet these needs is to incorporate the lanthanide complex into a polymer matrix in order to obtain more stable composite material. In the present communication we report a luminescent nanocomposite (NC) made of Eu^{3+}-based coordination compound $[Eu(\mu_2\text{-}OC_2H_5)(btfa)(NO_3)(phen)]_2 \cdot phen$ and an oligomer matrix of poly-N-epoxypropylcarbazole (PEPC). The nanocomposite shows good PL efficiency along with improved thermal stability.

The nanocomposite $[Eu(\mu_2\text{-}OC_2H_5)(btfa)(NO_3)(phen)]_2 \cdot phen/PEPC$ was obtained from chemical solutions at different molar ratios of coordination compound into polymer matrix. Deposition of the nanocomposite films on quartz substrates was performed applying the spin-coating method. Photoluminescence (PL) spectra of the NC (Fig. 1) reveal characteristic atomic-like narrow emission bands associated with internal 4f-4f radiative transitions of Eu^{3+} ion, $^5D_{0,1} \rightarrow {}^7F_J$ (J = 0–4). The excitation spectrum (Fig. 2) contains a broad band (≈ 300–500 nm) related to the matrix, as well as a number of narrow excitation bands, determined by the internal transitions within the Eu^{3+} ion.

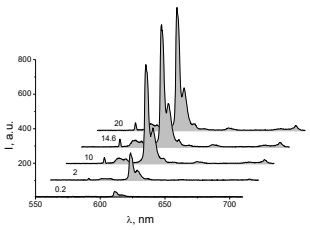

Figure 1. Emission spectra of the of the NC for different concentrations of the Eu^{3+} complex.

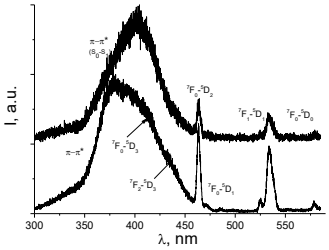

Figure 2. Excitation spectrum of the Eu^{3+} complex (down) and of NC sample 20% (up).

Variation in the PL emission intensity with Eu^{3+} complex concentration shows that PL quenching appears at concentration of about 10%, as expected based on literature data. The broad band in the excitation spectrum of the nanocomposite is shifted to infrared, from ~375 to ~402 nm, compared to coordination compound [1]. The intrinsic quantum yield of the NC, evaluated from PL decay profile, is found to be 32.7%. The radiative parameters of the NC are comparable with corresponding values of the original Eu $^{3+}$ complex [1] and demonstrates a good potential for practical applications.

ACKNOWLEDGEMENTS: This research was funded by the Ministry of Education and Research of the Republic of Moldova (subprograms 011201, 010602).

[1] I.P. Culeac et all. *Nanomaterials* **12**, 2788 (2022).