Peter P Pershukevich et al., J Material Sci Eng 2017, 6:7 (Suppl)
DOI: 10.4172/2169-0022-C1-079

New light-emitting materials for optical technologies based on complexes with europium

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Complex compounds of lanthanides have been extensively studied for many years and interest in them is increasing due to their unique optical properties and a wide range of applications. With the development of nanotechnology, new opportunities appeared in the development of complex compounds of lanthanides with new properties. Particularly important among them are thermal and radiation stability, volatility in vacuum, photostability, durability, homogeneity, etc. Many methods for modifying lanthanide complex compounds, in particular europium (III), have been described in the literature. In the present work, an attempt has been made for the first time to modify coordination compounds by synthesis of nanostructured supramolecular complexes of europium (III), in which nanodiamonds were used as templates. As the initial coordination compounds, two well-tested multiligand complexes of europium were used: the first with tris(tenoyltrifluoroacetonate) and 1,10-phenanthroline (Eu $(TTA)_3Phen$) (also EuT); the second with bathophenanthroline and NO_3 groups (Eu $(BPhen)_2(NO_3)_3$) (also EuB). The totality of the data obtained by us on electron scanning microscopy, spectral-luminescent characteristics, IR and EPR spectra clearly indicates the formation of new complexes with ND as a result of targeted synthesis. Its physicochemical properties differ significantly from those of the initial coordination compounds. It has been revealed that the advantages of complexes with nanodiamonds are: higher photostability (2-3 times), a spectrum with predominant emission in one narrow band $^5D_0$-$^7F_2$ (~ 615 nm), a higher luminescence brightness when excited in the far UV region of the spectrum. New luminescent complexes of lanthanides with ND in the composition of polymer matrices can be used: as luminescent substances in OLED; as active materials for detectors and dosimeters of ionizing radiation; as active laser media.

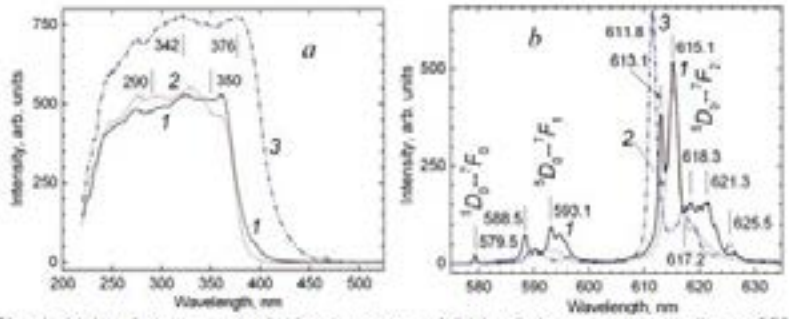

Fig. 1. (a) Luminescence excitation spectra and (b) luminescence spectra (λ_{exc} = 350 nm) of polycrystalline powders: (*1*) $Eu(BPhen)_2(NO3)_3$ complex (λ_{max} = 615 nm), (*2*) supramolecular ND–$Eu(BPhen)_2(NO_3)_3$ complex (λ_{max} = 615 nm), and (*3*) $Eu(TTA)_3Phen$ (λ_{max} = 612 nm).

Biography

Peter P Pershukevich, Victoria A Lapina and Tatiana A Pavich – scientific employees of the Institute of Physics of National Academy of Science of Belarus. Dr.V. Lapina has PhD in chemistry, leading scientific researcher. The main direction of her work is biomedical optics and nanotechnologies. She is authors more than 200 scientific papers, 20 patents. Dr. T. Pavich has PhD in chemistry, senior research scientist, specialist in the synthesis of complex compounds of lanthanides. She is authors more than 100 scientific papers, 3 patents. Dr. P. Pershukevich has PhD in physical and mathematical sciences, deputy head of the scientific center, specialist in spectroscopic research, especially luminescence methods, various radiating materials: porous silicon and porous aluminum, inorganic and organic luminophores activated with lanthanides, and others. He is the author of more than 150 scientific papers, 8 patents.

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