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Structural Rigidity and Blue Luminescence in a Lanthanum(III) Complex: A Case Study with 1,10-Phenanthroline

The search for sustainable and efficient solutions in the solid-state lighting field has gained significant importance due to its environmental impact. One such solution is light-emitting diodes (LEDs), which offer higher energy efficiency and durability than conventional lighting technologies such as incandescent bulbs and fluorescent tubes. Nowadays, LED technology has evolved to the development of organic LEDs (OLEDs), which have emerged in the technology industry due to their versatile optoelectronic applications, e.g., in a flat display of televisions and cell phones, as well as flexibility, low voltage, and fast response. In this work, a blue-emitting phosphor designed by lanthanum (III) coordinated with 1,10-Phenanthroline, [La(Phen)2(NO3)3], was obtained by an effective and low-energy precipitation method. Infrared spectroscopy (IR) and X-ray diffraction (XRD) revealed the compound coordination environment and crystal structure. The luminescence properties, absolute quantum yield (Φ), and luminescence lifetime decay (τ) were determined by photoluminescence spectroscopy. In addition, the chromatic coordinate CIE 1931 and color purity are reported. It is highlighted that the complex [La(Phen)2(NO3)3],] displayed a deep blue emission related to the electronic transitions of the 1,10-Phenanthroline, which is not perceptible in its free form as an organic ligand. This experimental observation is due to the structural rigidity caused by the coordination with the Lanthanum ion. The results will be discussed regarding a possible application as a blue-emitting phosphor, its organic nature, and the use of the promising material in OLED technology.

Keywords

Luminescence, Photoluminescence, Lanthanide complex, Lanthanum, Blue light-emission

Reference

S. Kim, "Design of fluorescent blue light-emitting materials based on analyses of chemical structures and their effects,"Materials Science and Engineering R: Reports, vol. 99. Elsevier Ltd, pp. 1–22, Jan. 01, 2016.

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Author approval

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