World Academy of Science, Engineering and Technology
International Journal of Chemical and Molecular Engineering
Vol:19, No:01, 2025

Elaboration of Sustainable Luminescence Material Based on Rare Earth Complexes for Solar Energy Conversion

Authors : Othmane Essahili, Mohamed Ilsouk, Carine Duhayon, Omar Moudam

Abstract : Due to their excellent and promising properties, a great deal of attention has recently been devoted to luminescent materials, particularly those utilizing rare earth elements. These materials play an essential role in low-cost energy conversion technology applications, such as luminescent solar concentrators (LSCs). They also have potential applications in Agri-PV systems and smart building windows. Luminescent materials based on europium (III) complexes are known for their high luminescence efficiency, long fluorescence lifetimes, and sharp emission bands. However, they present certain drawbacks related to their limited absorption capacity due to the forbidden 4f-4f electronic transitions. To address these drawbacks, using β-diketonate ligands as sensitizers appears as a promising solution to enhance luminescence intensity through the antenna effect, where the ligand's excited energy is transferred to the europium ions. In this study, we synthesized β-diketonate-based europium complexes with phenanthroline derivatives, modified with various methyl groups, to examine their effects on the complexes' stability in poly(methyl methacrylate) (PMMA) films. Our findings reveal that these complexes exhibit remarkable red emission and high photoluminescence quantum yield. Stability tests under different conditions for 1200 hours showed that complexes with a higher number of methyl substitutions offer improved photoluminescent stability and resistance to degradation, particularly in outdoor settings. This research underscores the potential of chemically tuned phenanthroline ligands in developing stable, efficient luminescent materials for future optoelectronic devices, including efficient and durable LSCs.

Keywords : luminescent materials, photochemistry, luminescent solar concentrators, β-diketonate-based europium complexes
Conference Title : ICP 2025 : International Conference on Photochemistry
Conference Location : Zurich, Switzerland
Conference Dates : January 14-15, 2025