

Spectroscopic properties of porphyrins and effect of lanthanide ions on their luminescence efficiency.

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Rok wydania

2004

Czasopismo

Journal of Alloys and
Compounds

Numer woluminu

380

Strony

396-404

DOI

10.1016/j.jallcom.2004.03.065

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Spectroscopic properties of H₂TPP porphyrin and Tb(III)TPP(acac) in solid and methanolic solutions have been compared. Emission from the S₁ singlet state of Tb(III)TPP(acac) have been recorded at 296 and 77 K. Spectroscopic investigations of new types of porphyrins soluble in organic solvents (e.g. methanol), PP(AA)₂, and porphyrins soluble in water, PP(AA)₂(Arg)₂ (where AA, alanine or serine; Arg, arginine), are presented. Interaction of PP(AA)₂ with lanthanide ions (Yb(III), Eu(III)) has been studied. It has been found that the lanthanide (III) ions decrease efficiency of the porphyrin emission. For the alanine derivative, the stronger losses are caused by the Eu(III) ions as compared to the Yb(III) ions. On the other hand, the emission quenching by both lanthanide ions is similar in the case of the serine derivative. Influence of the Pr(III) and Eu(III) ions on the PP(AA)₂(Arg)₂ emission has also been investigated. An unexpected increase of the porphyrin emission intensity has been observed in solution for the lowest concentration of Pr(III) added, whereas the Eu(III) ions quench the emission in the full range of its concentration. The observed phenomena are analyzed, and the mechanisms of the excited-state dynamics in which the f-excited states take part in the porphyrin emission quenching are considered. It has been found that the lanthanide ions influence the absorption spectrum as well as the relative intensities of the respective bands in the emission spectra. The luminescence intensities of these porphyrins as a function of pH, the concentration and the type of the porphyrine substituent have been analyzed. Significant influence of the above factors on the emission properties of the porphyrins has been found and discussed. Efficiency of the emission has been determined for these M-porphyrin systems in comparison to the free porphyrins in methanol solutions. The observed effects can be explained by formation of polymeric chains and decrease of face-to-face agglomeration that leads to effective quenching.

Plik został wygenerowany dnia 2026-08-26 15:32:11

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