含吡啶、茀及不同芳香環中心之五環共軛螢光材料之研究

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摘要

本實驗主要是以Heck Coupling Reaction、Sonogashira coupling Reaction合成出一系列含吡啶、茀及不同芳香環中心之五環共軛螢光材料；所有化合物經由H^1-NMR、C^{13}-NMR 和元素分析加以鑑定其結構與純度，再與不同的質子予體酸製備成氫鍵錯合物。在熱性質方面，以熱重分析儀(TGA)得知熱裂解溫度(T_d)為 417℃~436℃。由熱微差掃瞄分析儀(DSC)與偏光顯微鏡(POM)觀察出合配製成的氫鍵錯合物中，除了PFBFP3OMe系列外皆顯現了向列型液晶的性質。化合物的螢光性質則由紫外光可見光光譜儀（UV-Vis）和螢光分光光譜儀測得，化合物在極稀(10^{-5} M)的THF溶劑中所得到的最大吸收波長範圍為 382nm~404 nm；最大螢光（PL）放射波長為 415 nm ~440 nm，化合物為發藍光及藍綠光材料，量子效率為 43%～51%。當配置氫鍵錯合物時所取用的酸pH值越強，越容易形成氫鍵錯合物，由於拉電子效應變強，分子LUMO變低，

Energy Band Gap就變窄，所以酸度最強的THDA配成氫鍵錯合物後，其造成紅位移的現象最為明顯。循環伏安法(CV)測得不可逆氧化電位，得知本系列化合物HOMO位於 5.53 eV ~ 5.64 eV。由於還原電位不明顯，經由$\lambda_{max\ onset}$推算得知LUMO位於 2.71 eV ~2.82 eV。在液晶性質和發光特性相結合的偏極化實驗中，成功發現共軛螢光分子在液晶相(配位後)中可發出具有方向性的偏極化光，且Polarization Ratio為 3.46 倍。

Study of Novel Photoluminescenet Materials Containing Five Conjugated-rings with Pyridine, Fluorene and Various Central Aromatic Cores

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Abstract

A series of novel photoluminescent materials with five conjugated aromatic segment including end-capping pyridine and various central aromatic cores were synthesized successfully via Heck coupling reaction, Sonogashira coupling reaction. Hydrogen bonding complexes were obtained from the mixing of these photoluminescent compounds with different proton donors containing carboxylic acids groups in THF. The thermal properties of these materials were measured by TGA. The decomposition temperature at 5% weight loss (T_d) of all compounds ranged from 417℃~ 436 ℃. DSC and POM claimed that most of these compounds have mesogenic phase except PFBFP3OMe. The optical properties of these materials were measured by UV-Vis and PL (photoluminescence) spectroscopic studies. These compounds exhibited maximum absorption in the range of 382 nm~404 nm in diluted THF. They emitted blue fluorescence around 415~440 nm in THF. The quantum efficiency of them were ranged from 43% ~ 51% comparing to 9,10-diphenylanthracene. For a good formation of Hydrogen-bonding

complexes, the highly acidic proton donor should be used . The energy band gap was shortened once the Hydrogen-bonding complexes were formed. According to the PL spectra, all the complexes whose contain THDA showing the most apparent red-shifted emission due to its lowest pk_a value. The CV showed that the HOMO and LUMO of these com- pounds were located at 5.53 eV ~ 5.64 eV and 2.71 eV ~ 2.82 eV respec- tively. The polarization measurement showed the existence of the polariz- ed light and the polarization ratio is about 3.46.