2018 中華民國高分子學會年會
Annual Meeting of the Polymer Society (AMPS2018)
國立臺北科技大學
壁報編号：PII-B-63

Control of FRET-driven Fluorescence and Phosphorescence Properties of Polyimides and co-Polyimides

Mayuko NARA, Ryoji ORITA, Kenta KANOSUE, Ryohei ISHIGE, Shinji ANDO*

Department of Chemical Science and Engineering, Tokyo Institute of Technology
E-mail: mnara@polymer.titech.ac.jp

ABSTRACT:
We have recently synthesized polyimides (PIs) exhibiting both the fluorescent and phosphorescent abilities, which exhibit various luminescence colors. In particular, phosphorescent PIs can be applied to solar spectrum convertor because of their extremely large Stokes shifts. However, some phosphorescent PI films show absorption bands in the visible region, originating from their aggregation state, which deteriorates the optical transparency. In this study, we synthesized new copolyimides (co-PIs) from ODPA (4,4'-oxydiphthalic dianhydride) and BPMDA (3-bromopyromellitic dianhydride) as dianhydrides, and DCHM (4,4'-diaminocyclohexylmethane) as a diamine and tried to control the absorption and luminescence properties based on the Förster resonance energy transfer (FRET). We also synthesized two kinds of homopolyimide, ODPA/DCHM (OD-PI) which is colorless and exhibits blue fluorescence (400 nm) and BPMDA/DCHM (BP-PI) which shows an absorption band at a short wavelength in the visible region and exhibits red phosphorescence at 590 nm. Based on the UV-vis absorption measurements, the co-PIs show lower absorption in the visible region than BP-PI. We also examined the luminescence properties of the PIs. By exciting the ODPA moiety at 340 nm, the co-PI exhibited blue and orange emissions (530 nm) which are assignable to the ODPA moiety and the aggregation state of BPMDA, respectively. These results indicate that FRET from ODPA occurs more effectively to the BPMDA aggregate than that of isolated chain. Furthermore, the co-PI showed much longer luminescence lifetime (τ=155 ms) than that of BP-PI (τ=11 ms) at 77 K. The long-lived luminescence emitted from the aggregation state of the co-PI could be attributable to some factors such as triplet-triplet annihilation. In summary, it was demonstrated that the absorption and luminescence properties of PIs can be controlled by copolymarization of two different kinds of dianhydrides, that is less absorption of visible light and long-lived luminescence based on FRET.
Keywords: Polyimide, Copolyimide, Fluorescence, Phosphorescence, FRET