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Extended Abstract

Highly Fluorescent Properties of Imide Compounds Having Two Intramolecular Hydrogen Bondings

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I. Introduction

Fluorescent materials can be used in many fields such as organic light emitting displays and spectrum converters for liquid crystalline displays and solar cells. (Fig.1). Recently, polyimide, a well-known super engineering plastic which exhibits high thermal and chemical stability, has been attracted much interests as a new class of thermally stable optical material. Previously, we have proposed a molecular design concept for highly fluorescent polyimides [1]. Moreover, we have found that an imide compound having a hydroxy (−OH) group in the anhydride moiety (3-HNHPI Fig.2b) exhibits more enhanced absorption and emission compared with *N*-cyclohexylphthalimide (NHPI, without −OH groups, Fig.2a). This should be due to changes in electronic transitions caused by intramolecular hydrogen bonding [2].

In this study, a novel imide compound (3,6-DHNHPI Fig.2c) having two −OH groups was synthesized to clarify the effects of the second −OH groups to the fluorescence properties of phthalimide compounds.

II. Experimental

The absorption and emission spectra were measured using Hitachi U-3500 spectrophotometer and Hitachi F-4500 spectrofluorometer. Fluorescence measurements were also performed under basic conditions using DBU as an organic base. Quantum yield for fluorescent emission (Φ) was estimated using an integrating sphere. The concentrations of imide compounds for fluorescence measurements were set to 1.0×10^{-5} M.

III. Results and Discussion

The values of Φ observed for chloroform solutions of NHPI, 3-HNHPI and 3,6- DHNHPI are shown in Fig.2. It should be noted that 3,6-DHNHPI having two −OH groups showed a blue emission stronger than the green emission of 3-HNHPI having one −OH group. Fig.3 shows the fluorescence spectra of 3,6-DHNHPI observed under basic conditions. When the concentration of DBU is higher than 10^{-2} M, 3,6-DHNHPI showed a green emission, which should originate from its deprotonated form (see Fig.3). In conclusion, the incorporation of −OH groups which form intra-molecular hydrogen bonding into imide compounds is a useful and attractive tool for enhancing their fluorescence properties, and moreover it makes imide compounds more sensitive to environmental conditions.

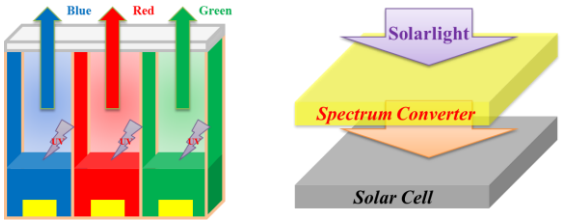

Figure 1. Schematic illustration of fluorescence materials

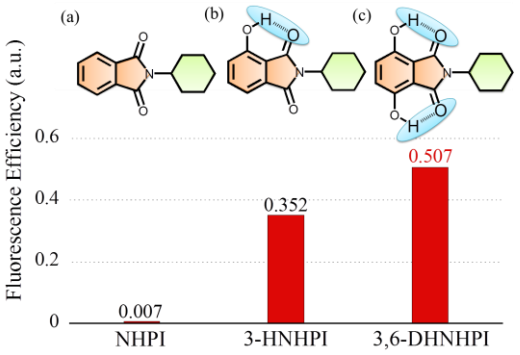

Figure 2. Chemical structures and fluorescence intensities of the three imide compounds

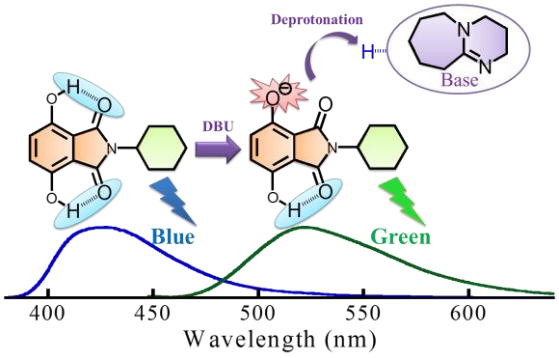

Figure 3. Fluorescence spectra of 3,6-DHNHPI under basic condition.

References

[1] J. Wakita, H. Sekino, K. Sakai, Y. Urano, S. Ando, "Molecular Design, Synthesis, and Properties of Highly Fluorescent Polyimides", *J. Phys. Chem. B*, **113**, pp. 15212-15224, October 2009.

[2] J. Wakita, S. Inoue, N. Kawanishi, S. Ando, "Excited-State Intramolecular Proton Transfer in Imide Compounds and its Application to Control the Emission Colors of Highly Fluorescent Polyimides", *Macromolecules*, **43**, pp. 3594-3605, April 2010.