소분자를 기반으로 한 녹색 발광전지화학 셀

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Small molecules based green light-emitting electrochemical cells

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Abstract

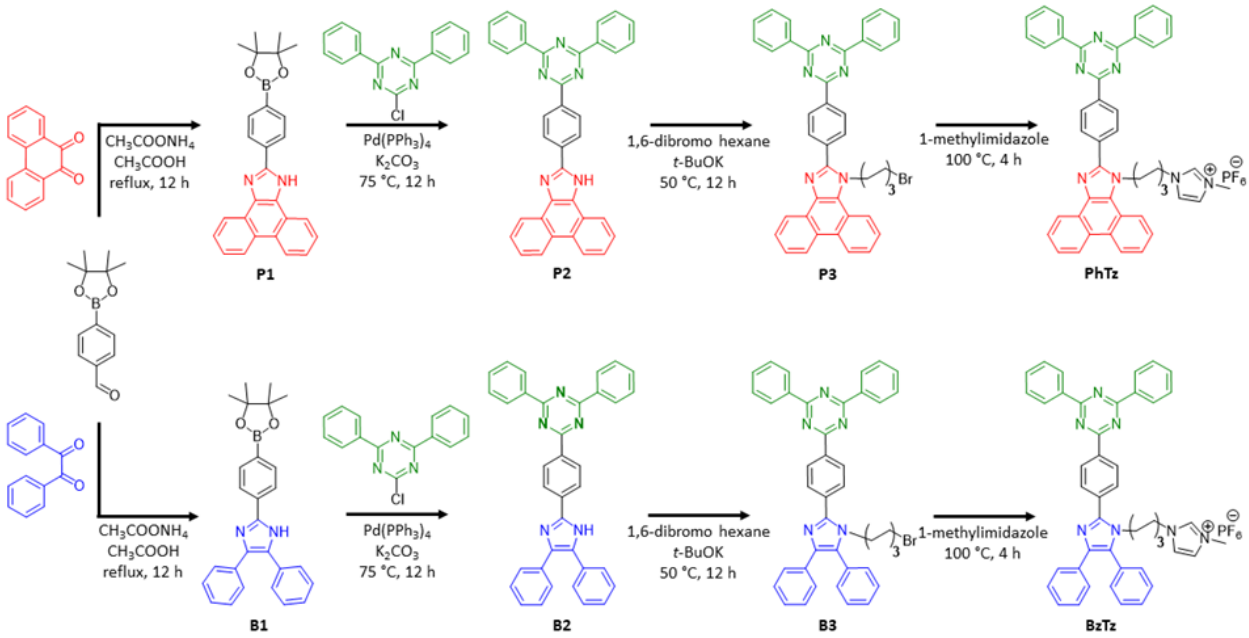
Two new ionic green-emitting Donor–Acceptor type emitters were designed and synthesized. The potential of diphenyl triazine as an acceptor was utilized here to generate excellent green emitters by coupling with two derivatives of imidazole donors. These synthesized emitters exhibited excellent solubility, high luminescence in solution and solid state, high thermal stability, and good film-forming abilities. Bright green emissions were achieved by applying these emitters in a light-emitting electrochemical cell (LEC) device stack.

INTRODUCTION

Light-emitting electrochemical cells (LECs) [1] are considered as one of the simplest kinds of electroluminescent devices and a potential replacement for organic light-emitting diodes (OLEDs). A typical LEC device consists of one or two electroactive layers sandwiched between two metal electrodes. Ionic organic small molecules (SMs) have established the applicability in solid-state lighting, and is seen as a potential candidate for active material to obtain higher device performance in LEC. The 1,3,5-triazine derivatives exhibited excellent properties due to their structure, with high symmetry, thermal stability, and electron transporting ability. The phenanthroimidazole and diphenylimidazole moieties are notable materials with many attractive features such as conductivity, luminescence, and ability to form donor–acceptor systems. To this core D–A system, an imidazolium ring containing two nitrogen atoms with

different bonding nature is chemically tethered via an alkyl chain to enhance solubility and carrier transport in LECs

EXPERIMENTAL SECTION



Scheme 1. Synthetic Routes for the Target Compounds

RESULTS AND DISCUSSION

Photophysical properties

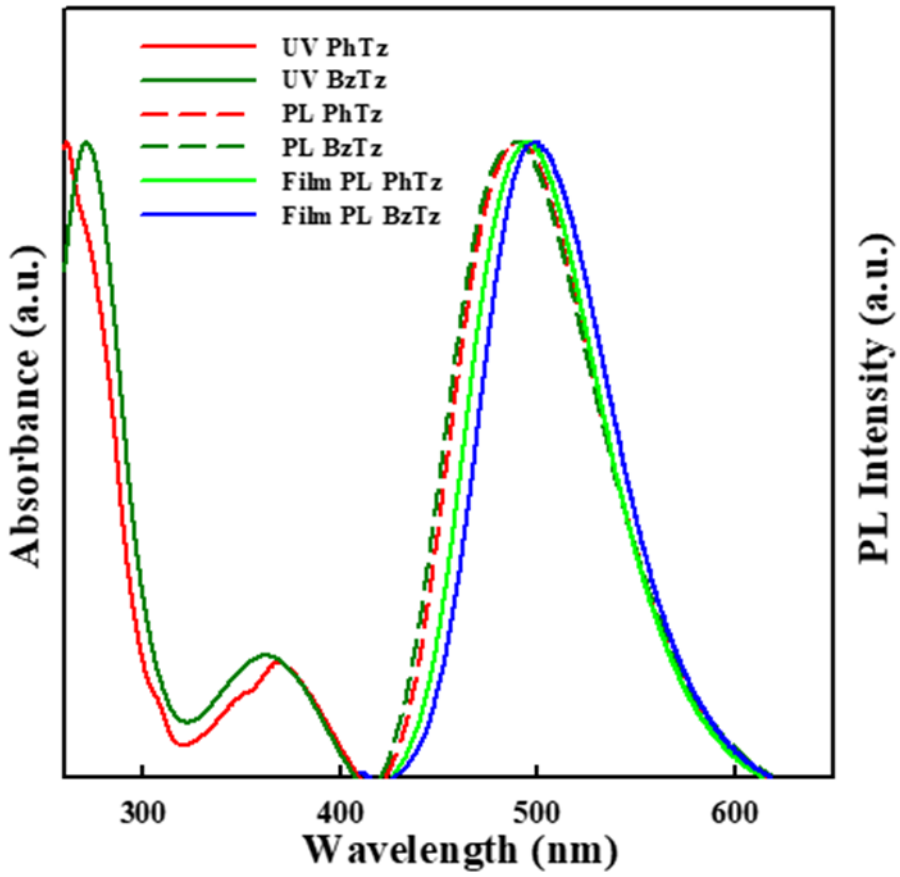


Fig 1. UV and PL spectra in THF solution (dotted lines), and thin-film emission spectra of PhTz and BzTz.

A band around 330–400 nm was obtained for both PhTz and BzTz. The emission spectra in THF solution were obtained by exciting both molecules at its absorption maximum, and the corresponding emission maxima was found at 490 nm with fwhm of 86 and 89 nm for PhTz and BzTz, respectively.

Electroluminescent Properties

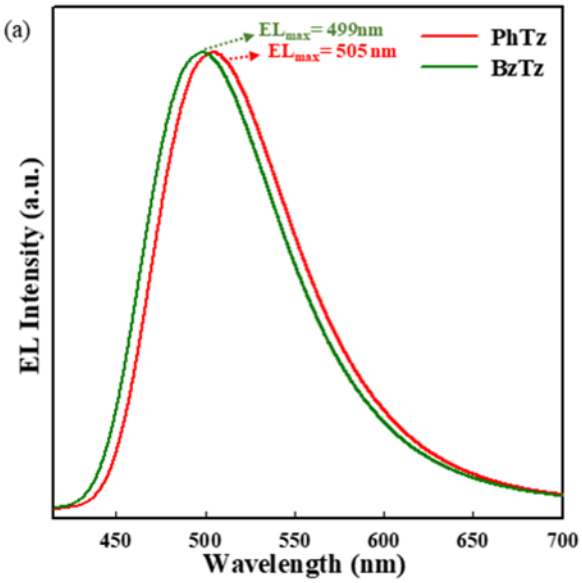


Fig 2. Normalized electroluminescence spectra of PhTz and BzTz devices.

BzTz and PhTz showed EL peaks at 499 and 505 nm with CIE 1931 coordinates of (0.27, 0.52) and (0.28, 0.54), respectively. These LECs showed a maximum brightness of 1453 and 1048 cd/m2, respectively, for PhTz and BzTz. The maximum current and power efficiencies achieved were 2.83 cd/A and 0.63 lm/W, respectively, for the PhTz-based device and 1.72 cd/A and 0.33 lm/W, respectively, for the BzTz-based device.

CONCULSION

In this work, we report the design and synthesis of two novel green fluorescent light emitting ionic small molecules having triazine acceptor. These new green emitters exhibited excellent solubility, high luminescence in solution and solid state, good film-forming abilities, and high thermal stability. The thermal stabilities were noted to be very high at 370 and 358 °C for these molecules. The glass transition temperatures were also noted to be very high 120 and 104 °C. These nondoped LEC device exhibited green emission at 505 and 499 nm with Commission Internationale de I'Eclairage coordinates of (0.28, 0.54) and (0.27, 0.52)

REFERENCES

[1]. Q. Pei, Yu, G., Zhang, Yang, C and Y. Heeger, A. J. Science, **269**, 1086– 1088, (1995)