



Tetraphenylethene-substituted 3,4,5-triphenyl-4*H*-1,2,4-triazole: Aggregation-induced emission, mechanochromism, electroluminescence and cell imaging

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INTRODUCTION

Among luminogens with aggregation-induced emission (AIE) characteristics, *N*-type molecules are rare in comparison with *P*-type and neutral species in spite of their indispensable roles in functions as electron transport and electron acceptor materials. In this work, tetraphenylethene-substituted 3,4,5-triphenyl-4*H*-1,2,4-triazole is endowed with remarkable aggregation-induced emission (AIE) and fluorescence switching properties. Thanks to its electron-deficient property, this molecule could serve as both light-emitting and electron-transporting layer on organic light-emitting diodes (OLEDs). Furthermore, this luminogen is also promising as a fluorescent visualizer in vitro cell imaging.

RESULTS AND DISCUSSION

Molecular Structure

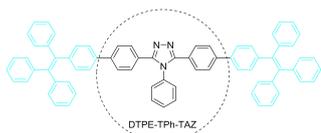


Chart 1. Chemical structure of DTPE-TPh-TAZ.

AIE-activity

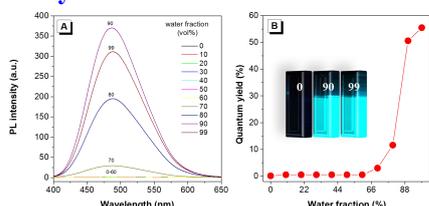


Figure 1. (A) Photoluminescent spectra of DTPE-TPh-TAZ in THF/water mixtures with different water fractions; (B) Variations of quantum yields with water fractions. Inset: Fluorescent photographs of DTPE-TPh-TAZ in THF/water mixtures with water fraction = 0, 90 and 99%. The pictures were taken under 365 nm UV irradiation from UV lamp.

Mechanochromisms

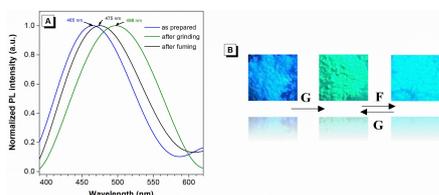


Figure 2. (A) PL spectra of DTPE-TPh-TAZ in condensed phases. (B) Fluorescent images of samples taken under UV-light.

CONCLUSIONS

Tetraphenylethene-substituted 3,4,5-triphenyl-4*H*-1,2,4-triazole possessing remarkable AIE and mechanochromic properties is designed and synthesized. This multifunctional *N*-type AIEgen could be used as light-emitting and electron-transporting materials on OLED and a fluorescent visualizer in vitro cell imaging.

Electroluminescence

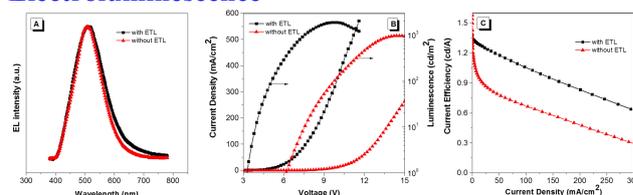


Figure 3. (A) EL spectra, (B) current efficiency-voltage-luminescence characteristics, and (C) changes in power and current with the applied current.

Device configuration:

I: ITO/NPB (60 nm)/DTPE-TPh-TAZ (20 nm)/TPBi (40 nm)/LiF (1 nm)/Al
II: ITO/NPB (60 nm)/DTPE-TPh-TAZ (60 nm)/LiF (1 nm)/Al

In Vitro Cell Imaging

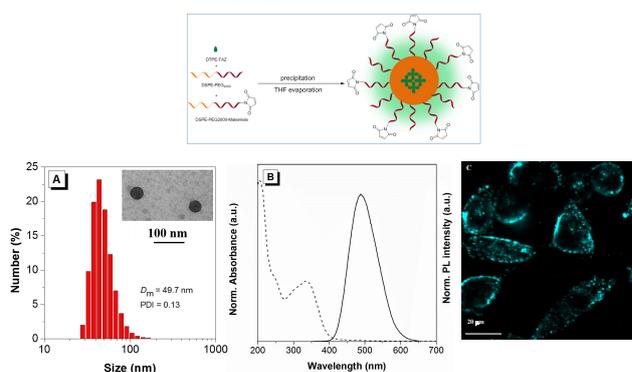


Figure 4. (A) Size distribution, D_m and PDI of AIE dots suspended in water. Inset in is the TEM image. (B) Absorption and emission spectra of AIE dots suspended in water; excitation wavelength: 335 nm. (C) Fluorescent image of HeLa cells incubated with 4 mM AIE dots for 2 h.

ACKNOWLEDGMENTS

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