Fluorescence Properties of AIE-Active Perylene Derivatives in the Aggregated State

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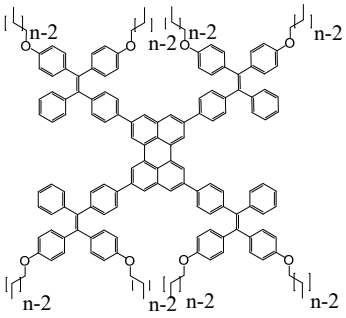
【Introduction】

Perylene derivatives have attracted attention as excellent fluorescent materials because of their high quantum yields. The perylene core aggregates easily to form a stacked organization due to its strong π-π interaction, therefore many reports have shown the appearance of discotic columnar liquid crystal phases in this series. In recent years, by controlling the aggregated structure with the highly ordered structure like liquid crystals, circularly polarized luminescence (CPL) materials have been developed. However, their quantum yields in the aggregated state are significantly reduced.



PT-Dn：n=18,12,8,6,0

Fig.1 The structure of PT-Dn

We have therefore aimed to improve the quantum yield in the aggregated state by introducing tetraphenylethene (TPE) cores, which is known as an aggregation-induced emission (AIE) molecule, into a perylene derivative. In this study, we synthesized disk-shaped PT-Dn (n=18, 12, 8, 6, 0) by introducing TPE moieties with alkyl chains into a perylene core (Fig.1), and investigated the luminescence behavior of each compound in the aggregated states.

【Result & Discussion】

PT-Dn (n=18, 12, 8, 6, 0) were characterized by ^{1}H NMR, and the POM images and the DSC curves showed that they had no liquid crystallinity. The optical properties were characterized by UV-vis and photoluminescence (PL) spectroscopy. From the results of PL measurements, the fluorescence quantum yields of PT-Dn (n=18, 12, 8, 0) in the aggregated states were lower than that in the dilute solution (Table 1).) However, the quantum yield of PT-D6 in the aggregated state was higher than that in the dilute solution. This property is a typical AIE behavior.

Table 1. The Quantum Yield of PT-Dn

	PT-0	PT-D6	PT-D8	PT-D12	PT-D18
solution	74%	2%	23%	35%	41%
aggregation	4%	**30%**	2%	6%	22%

In addition, the PL intensity changed depending on the alkoxy chain length (Fig.2). These results suggest that the aggregation structure changes with the length of the alkoxy chain.

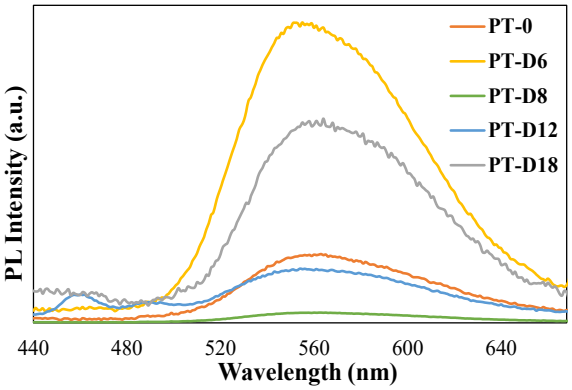


Fig.2 The PL Intensity of PT-Dn

1） Z. Zhao *et al.*, *Chem. Commun.*, **2010**, *46*, 2221.
2） X.-F. Duan *et al.*, *Synthesis,* **2007**, *5*, 713.