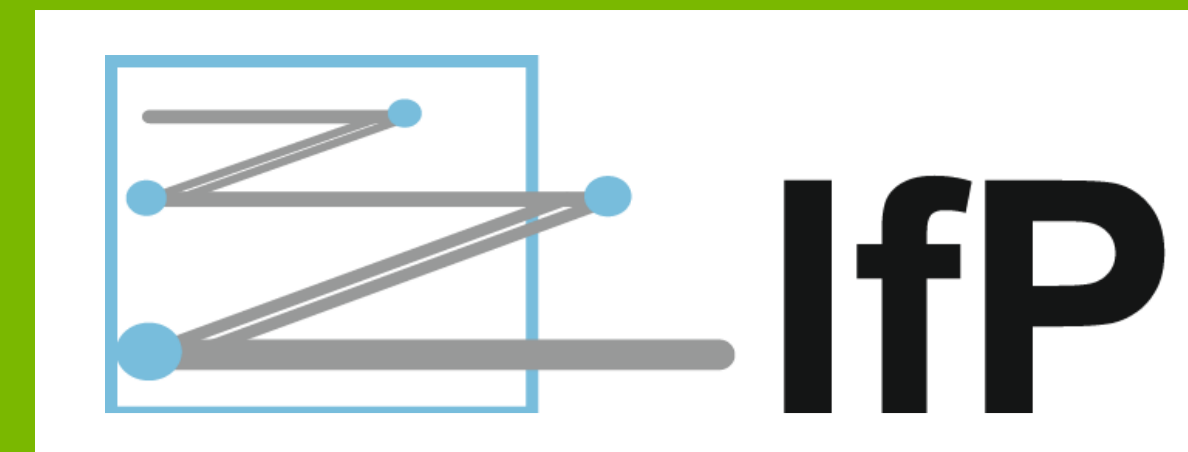




Aggregation-induced Emission and Amplified Explosive Detection of Tetraphenylethylene-substituted Polycarbazoles



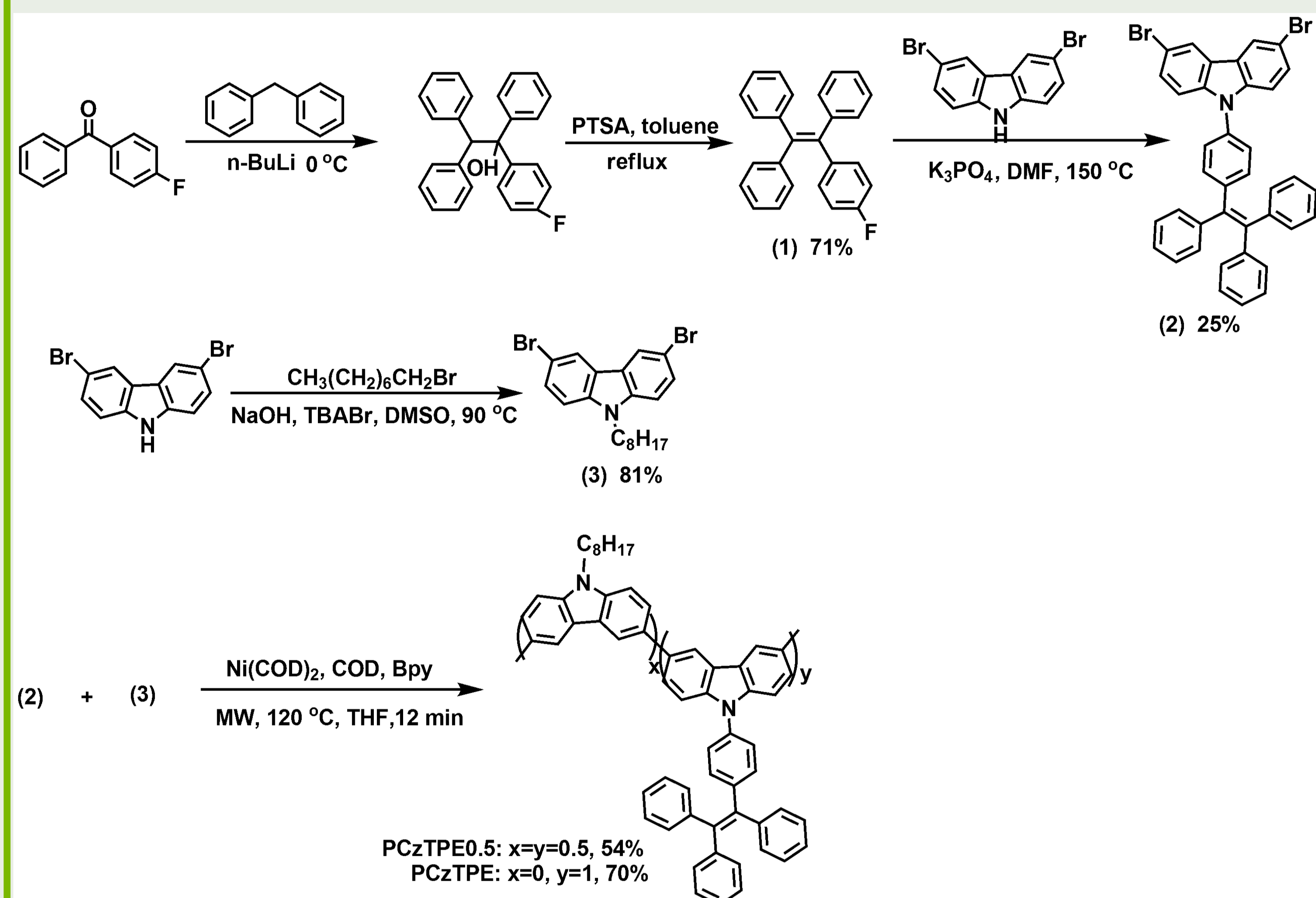
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Introduction

Molecules with aggregation induced emission (AIE) are weakly emissive in diluted solution but show an intense emission in the aggregated state, a behaviour that is opposite to the “conventional” aggregation induced quenching. Main reason for AIE behaviour is a restriction of intramolecular rotation. Tetraphenylethylene (TPE) is a prototypical AIE chromophore. Now, we introduced TPE side groups into polycarbazoles thus obtaining AIE-active polycarbazoles. Application of the polymers for nitroaromatic explosive detection was investigated in detail.

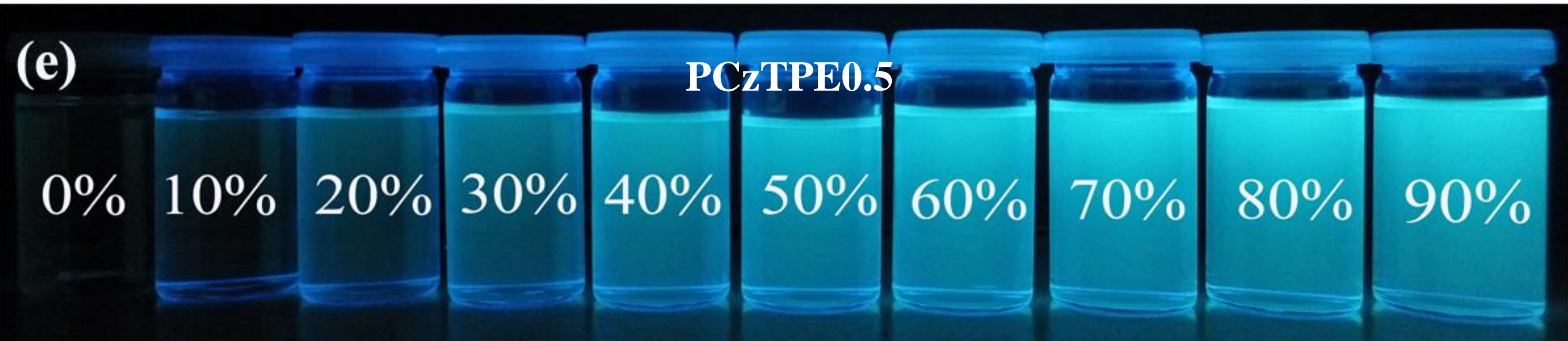
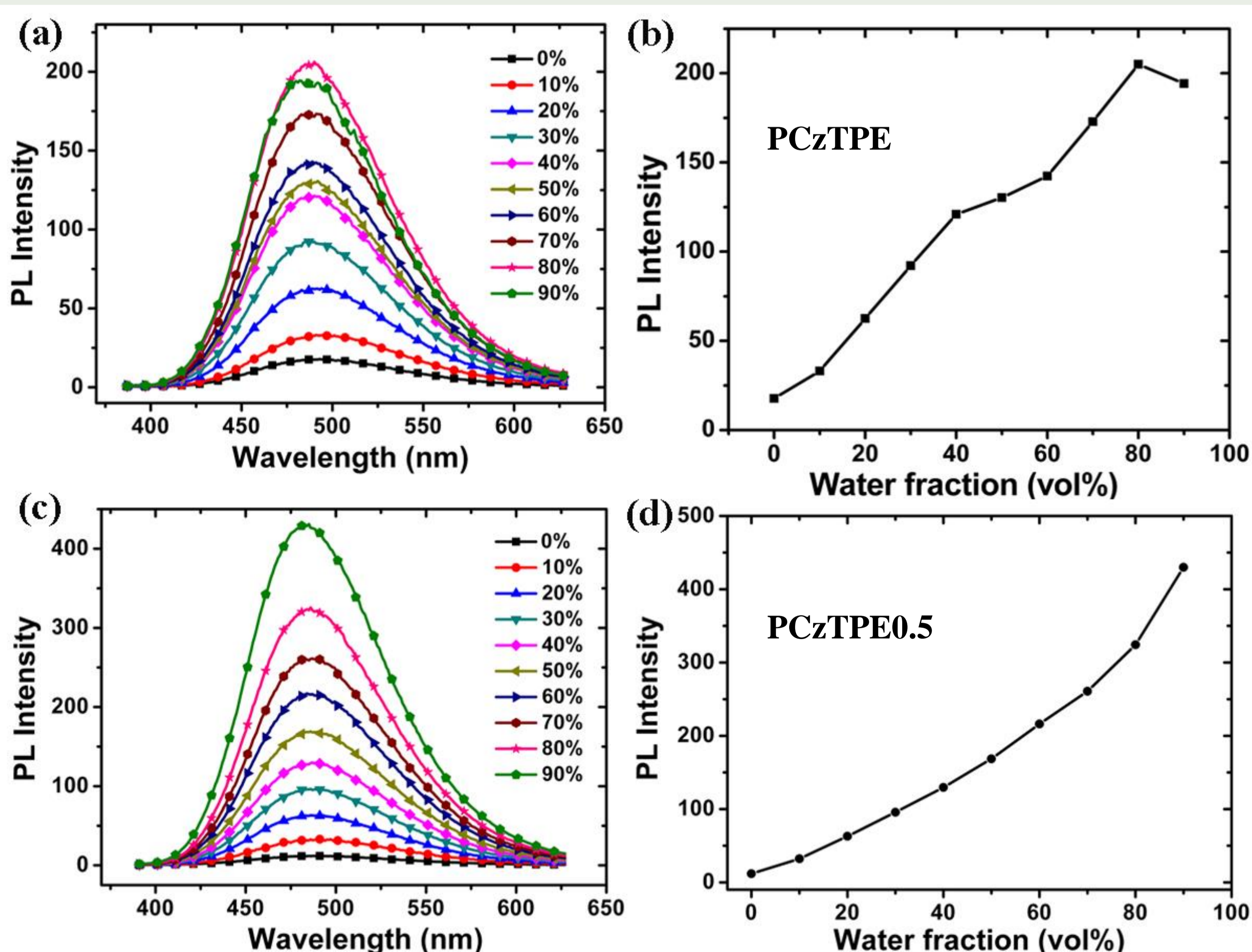
Synthesis



GPC results

	Mn	Mw	PDI
PCzTPE0.5	9200	23400	2.54
PCzTPE	6800	14300	2.10

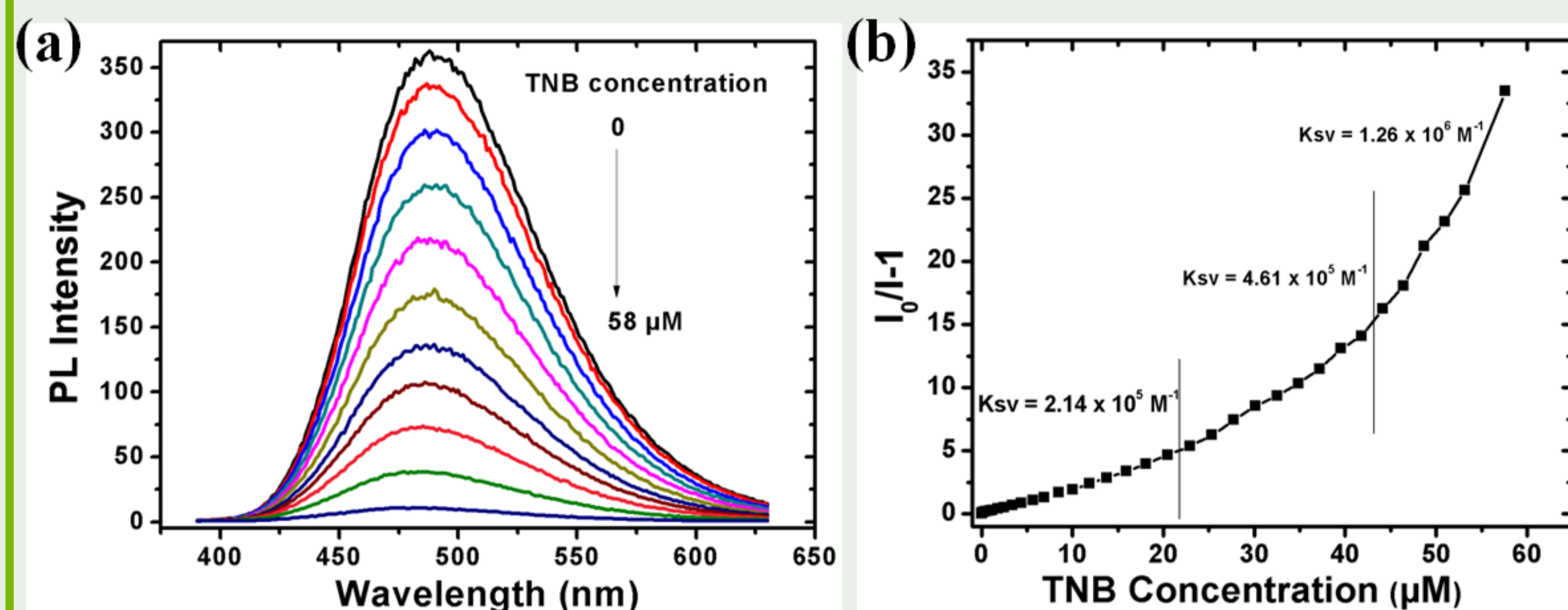
AIE characteristics



PCzTPE and PCzTPE0.5 show distinct AIE behaviour with a PL intensity increase (α_{AIE}) of 12 and 36, respectively.

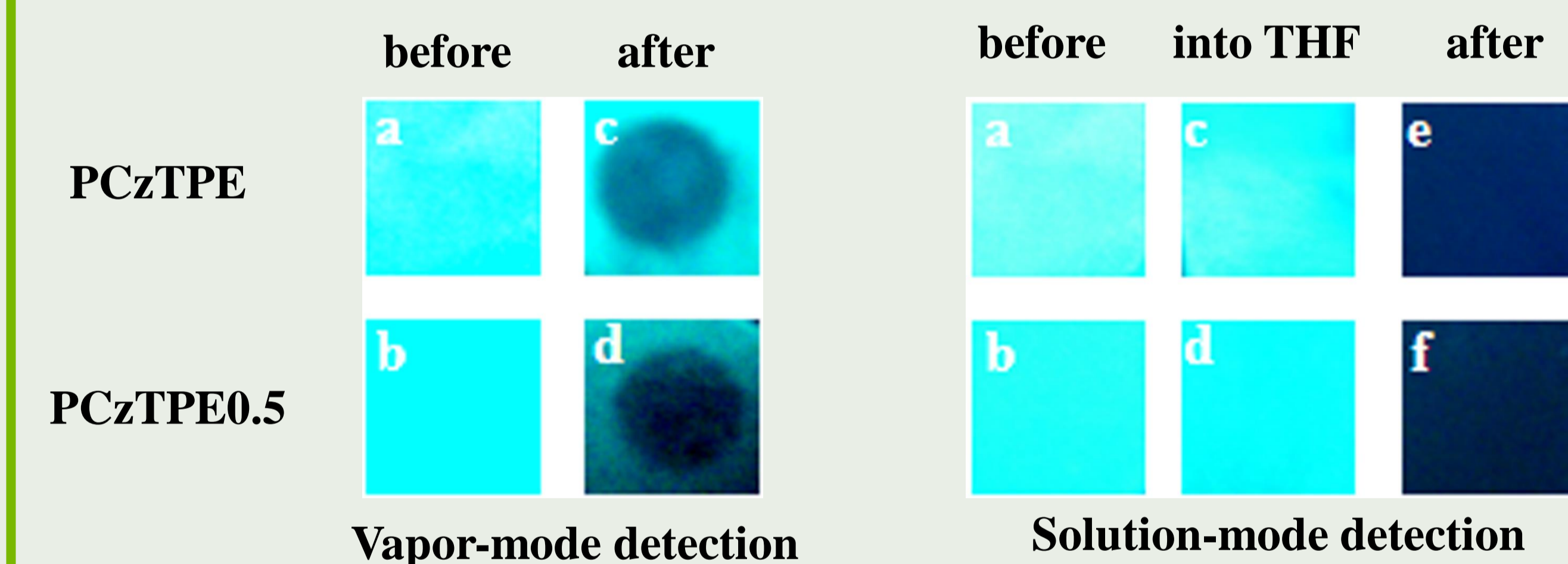
Application for explosive detection

PCzTPE0.5 aggregates in THF/water 1:9 for 1,3,5-trinitrobenzene (TNB) sensing



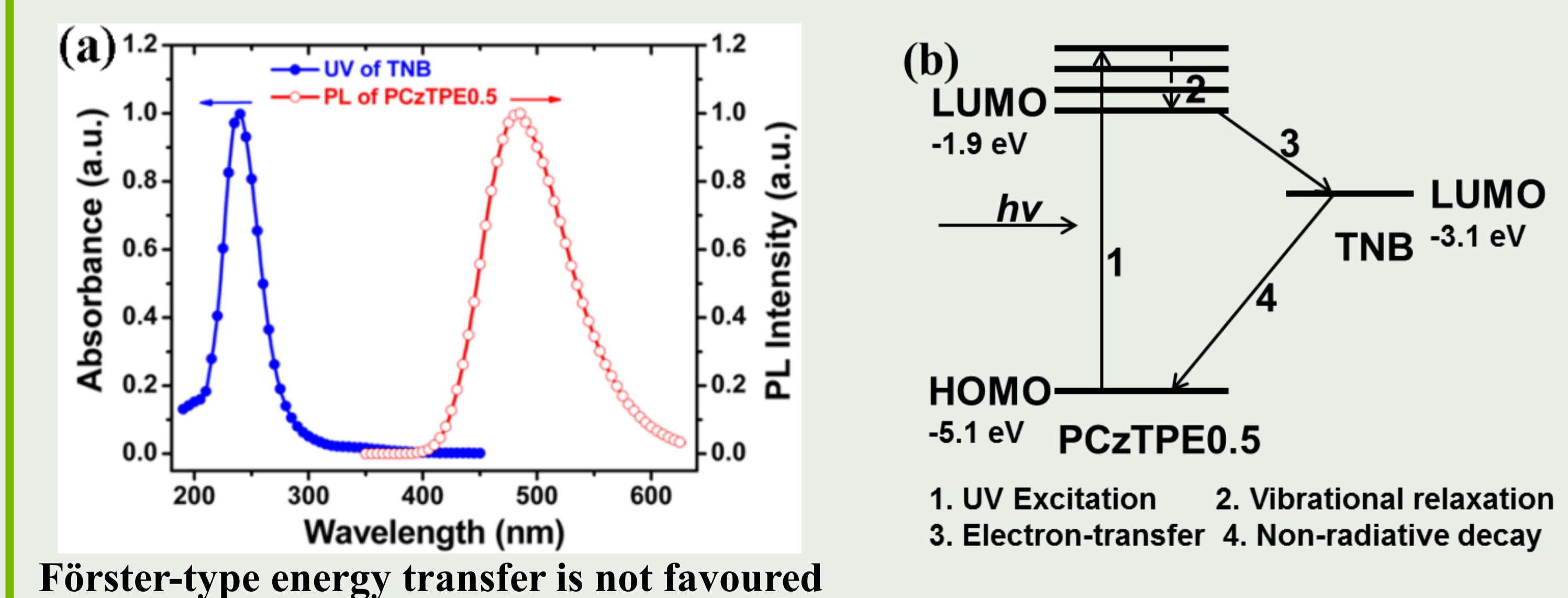
Aggregated PCzTPE0.5 shows amplified PL quenching during TNB addition with a maximum Stern-Volmer quenching constant of $1.26 \times 10^6 \text{ M}^{-1}$.

Paper strip tests



Paper strips with both polymers show TNB-induced PL quenching, both towards TNB vapor or TNB solution.

Mechanism



Conclusion

- Two polycarbazoles with AIE-active TPE side chains show distinct AIE properties.
- For sensing of TNB, PL quenching experiments were carried out. Aggregated PCzTPE0.5 shows amplified PL quenching during TNB addition with a maximum Stern-Volmer quenching constant of $1.26 \times 10^6 \text{ M}^{-1}$.
- Solid-state paper strips with both polymers show TNB-induced PL quenching, both towards TNB vapor or TNB solution, demonstrating promising practical application potential in solid state sensors for nitroaromatic explosives.

Acknowledgement

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Reference: W. Dong, T. Fei, A. Palma-Cando and U. Scherf, Polym. Chem., 2014, 5, 4048.