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An Artificial Light-Harvesting System Built from a Peptide-Based Triaxial Weave

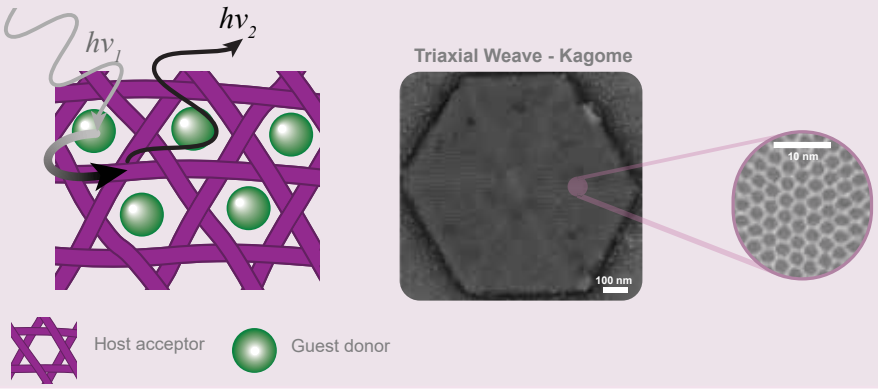
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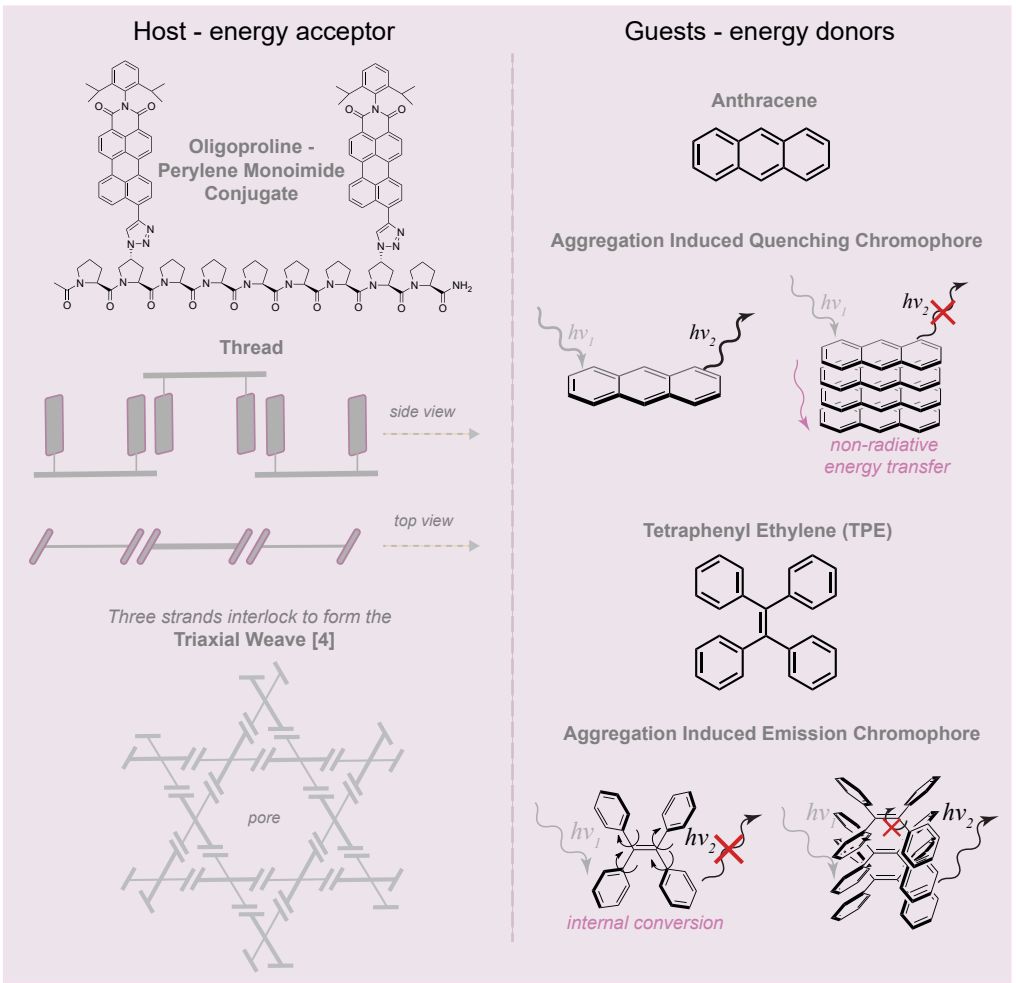
1 Introduction

Artificial light-harvesting systems (ALHS), which take inspiration from the principles of natural photosynthesis, have garnered significant attention for their potential in photocatalysis, bioimaging, and related photonic applications [1,2]. Typically, ALHSs rely on Förster resonance energy transfer (FRET) between a supramolecular host acting as the energy donor and an encapsulated fluorescent guest serving as the acceptor [3].

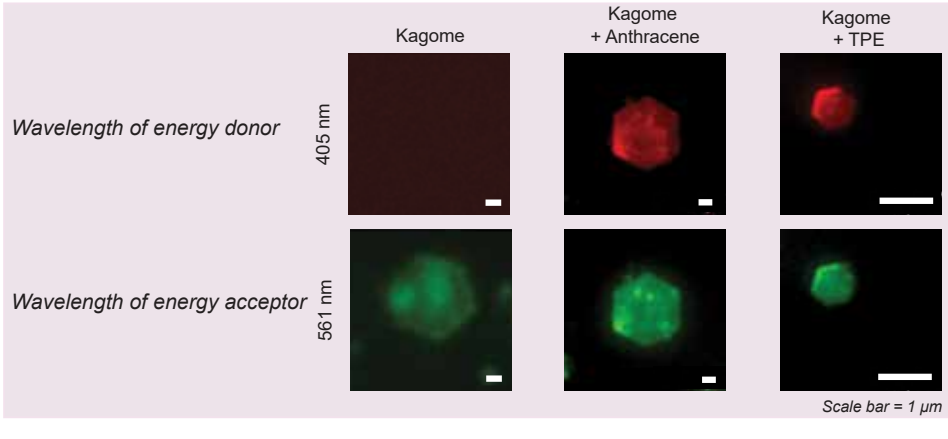
In this work, we introduce an inverted ALHS with reversed roles of the donor and acceptor. This work builds on our previously developed triaxial supramolecular weave, which is formed by the self-assembly of a rigid oligoproline scaffold bearing two perylene monoimide chromophores [4].



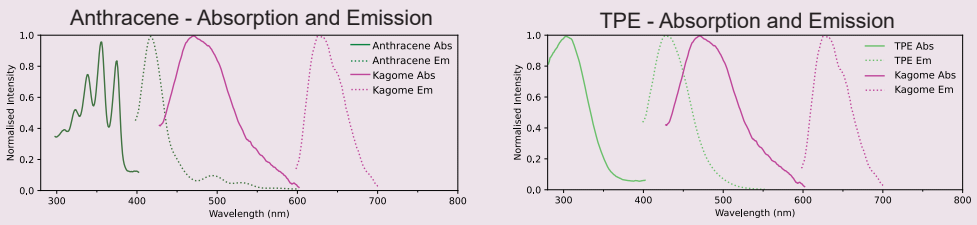
2 Our System



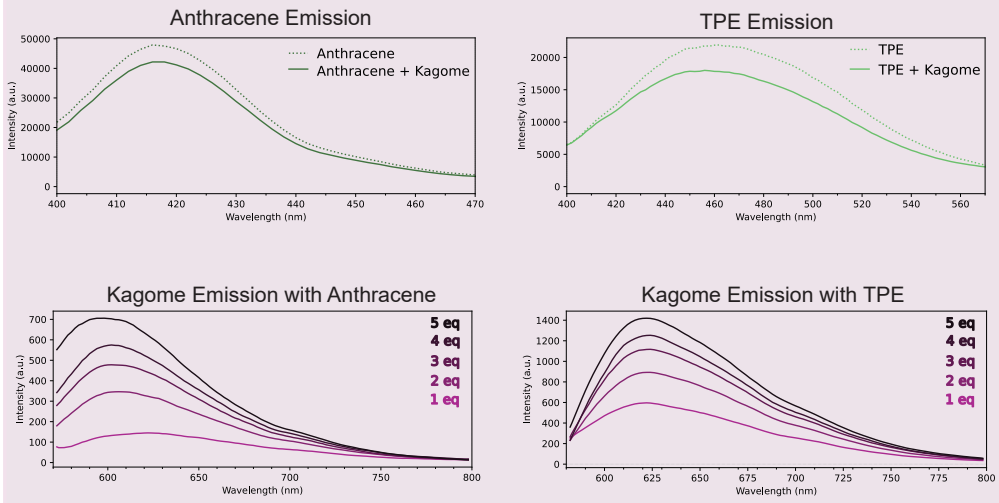
3 Fluorescence Microscopy



4 Förster Resonance Energy Transfer



The weave was incubated with increasing equivalents of anthracene or TPE, and the fluorescence spectra of the host - guest systems were measured at an excitation wavelength of 350 nm.



5 Further Characterisation

Fluorescence lifetimes and energy transfer efficiencies of the donor - acceptor systems

Sample		τ_1	τ_2	Φ_{ET}
Anthracene	–	3.59	11.99	/
	+	3.36	10.94	13%
TPE	–	3.66	7.06	/
	+	2.74	5.81	19%

6 Conclusion

- Fluorescence microscopy showed encapsulation of anthracene and TPE inside the triaxial supramolecular weave.
- Fluorescence spectroscopy revealed that the emission of anthracene or TPE was quenched upon their addition, relative to the emission of the free guest, further indicating encapsulation.
- At constant concentration of the weave, increasing amount of the donor enhanced fluorescence at 650 nm, the wavelength characteristic of perylene monoimide.
- The reduced fluorescence lifetime of both TPE and anthracene, in the presence of the weave, shows that both energy donors engage in energy transfer with the weave.

➢ The results demonstrate that both systems operate as reversed ALHSs.

➢ The ALHS with the energy donor TPE performed better than the ALHS with anthracene. This finding is consistent with the better spectral overlap between TPE and the weave, and with the aggregation induced emission property of TPE.

References

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