Cove-edged nanographenes as a potential optical-gain media for lasing

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Abstract

The application of zigzag- and armchair-edged nanographenes (NGs) for the development of solid-state lasers has been compromised by their limited solubility and spontaneous aggregation[1][2]. In this work, we study a cove-edged nanographene, hexa-peri-hexabenzo-bis-peri-octacene (**HBPO**), a novel material with improved solid-state solubility due to its contorted geometry and bulky substituents. In order to characterize the optical gain, we performed Transient Absorption Spectroscopy (TAS) measurements of **HBPO** in solution and in a HBPO-PS thin film composite. In solution, stimulated emission (SE) is revealed by a sharp feature at 613 nm coinciding with the 0-0 vibronic PL transition. TAS measurements of the composite confirmed an enhanced performance where SE outbalances excited-state absorption, paving the way for its application as solid-state optical gain medium. This conclusion was corroborated by Amplified Spontaneous Emission (ASE) measurements, obtaining an ASE threshold around 2.4 mJ/cm^2 in **HBPO**/PS films upon pumping at 465 nm. Our results are indicative of the great potential of NGs with cove edges for solid-state lighting applications.

References

[1] Y. Zou, et al., Angew. Chem. Int. Ed. 2020, 59, 14927-14934, (2020).
[2] Giuseppe M. Paternó, et al., Angew. Chem. Int. Ed. 2017, 56 (24), 6753-6757, (2017).

Figures

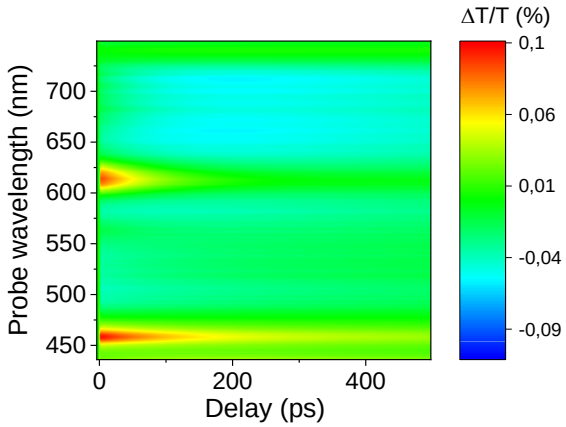

Figure 1: Fitted TA maps for **HBPO** in a **HBPO**/PS thin film taken at different pump-probe time delays.

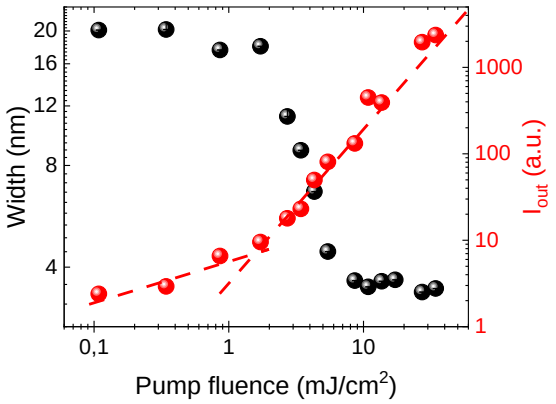

Figure 2: Input-output characteristics of ASE action and ASE threshold for the **HBPO**/PS thin film.