

## Supporting Information

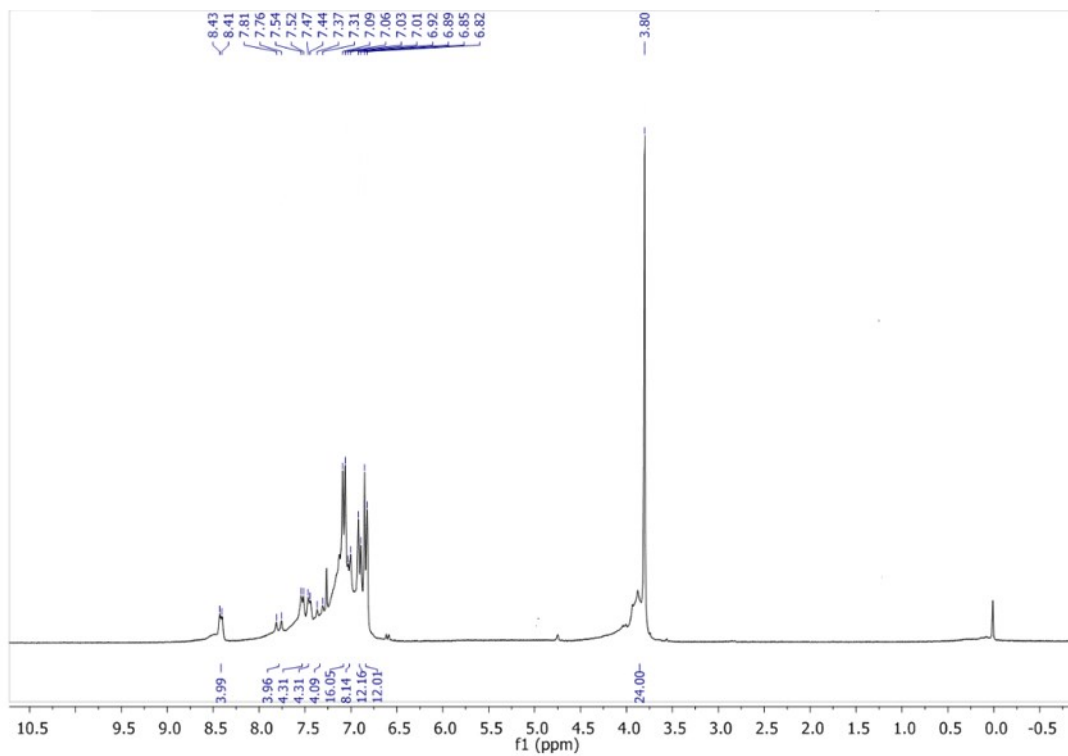
### **Novel star shaped D- $\pi$ -D- $\pi$ -D and (D- $\pi$ )<sub>2</sub>-D-( $\pi$ -D)<sub>2</sub>, anthracene-based hole transporting material for perovskite solar cells**

Muniyasamy Harikrishnan, Sepperumal Murugesan, Ayyanar Siva\*

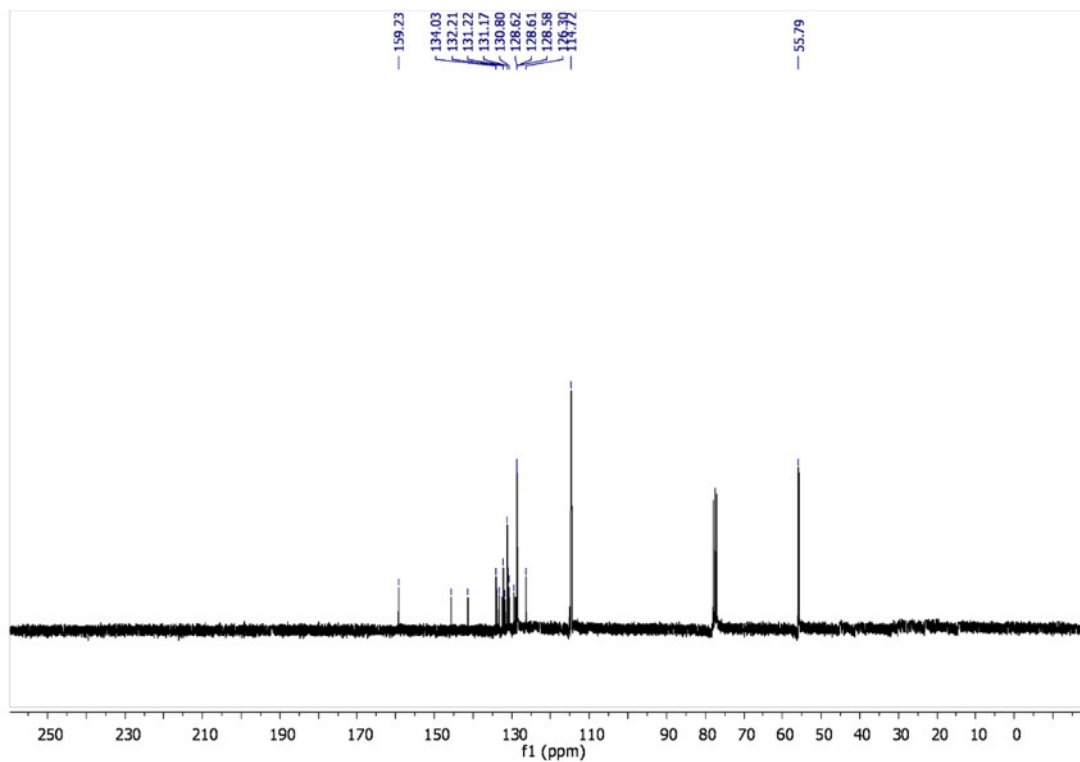
Supramolecular and Organometallic Chemistry Lab, Department of Inorganic Chemistry, School of Chemistry, Madurai Kamaraj University Madurai-21.

Corresponding author Email (drasiva@gmail.com and siva.chem@mkuniversity.org)

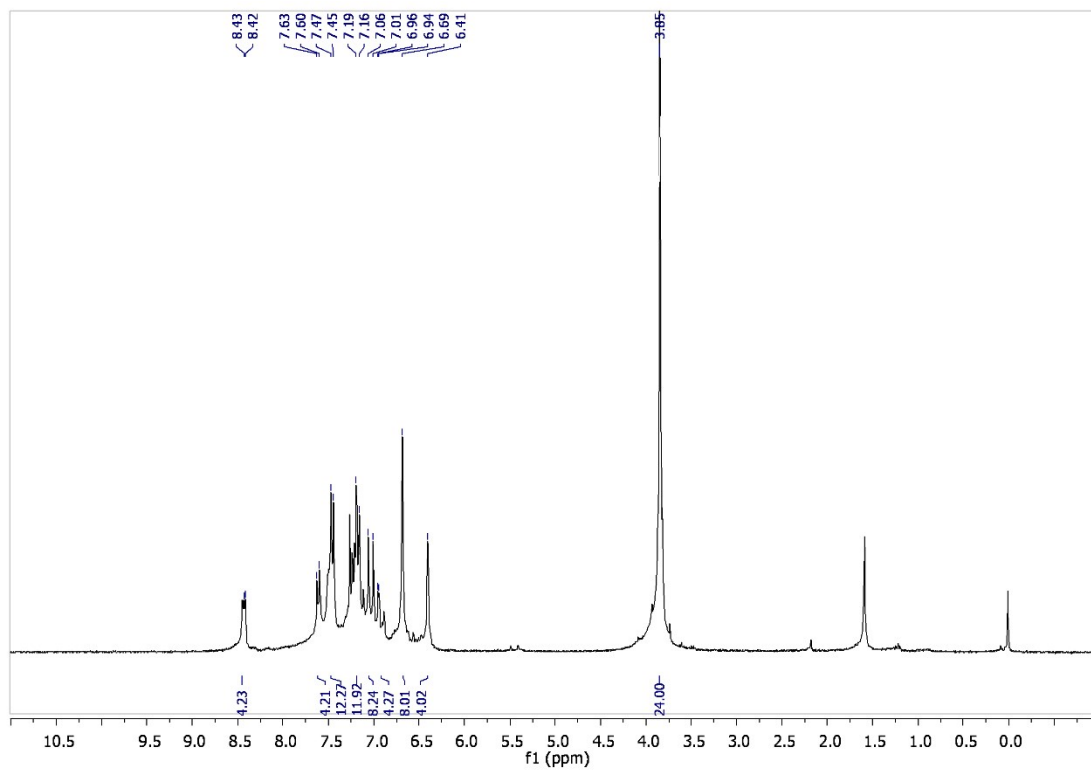
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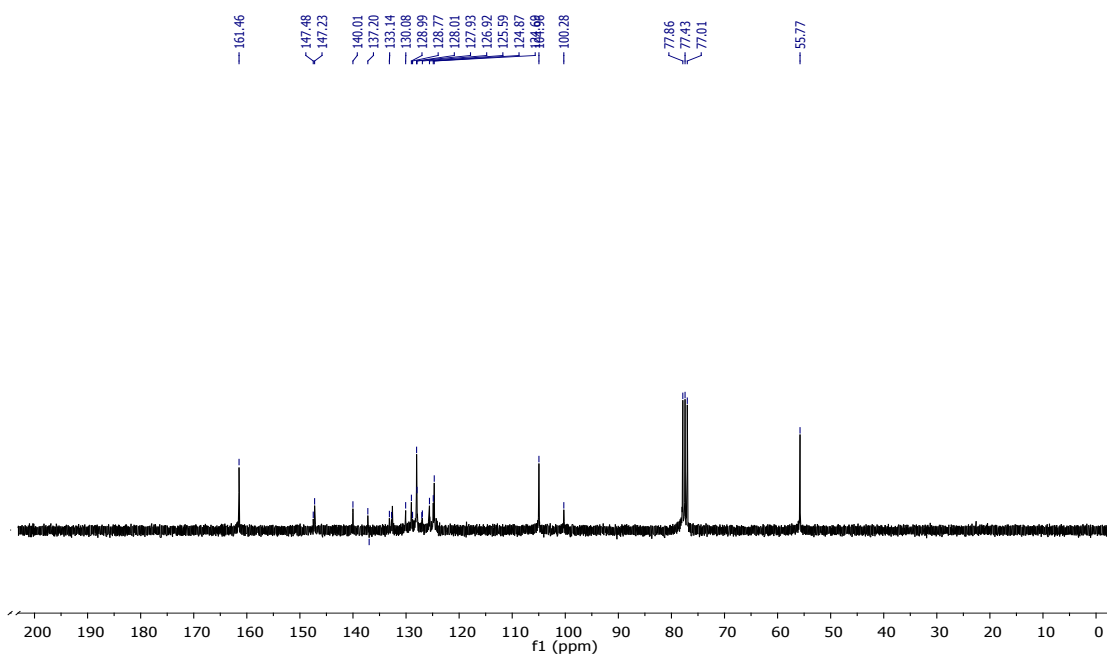
**Figure S1.**  $^1\text{H}$  NMR spectrum of compound ANTPA



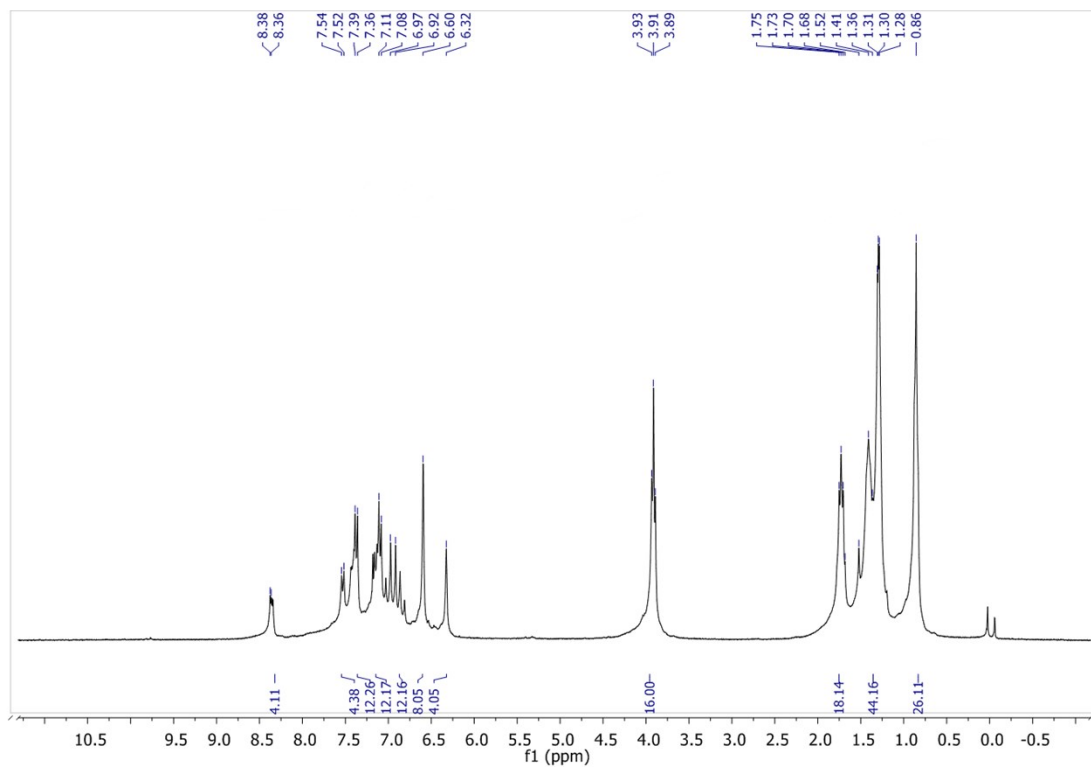
**Figure S2.**  $^{13}\text{C}$  NMR spectrum of compound ANTPA



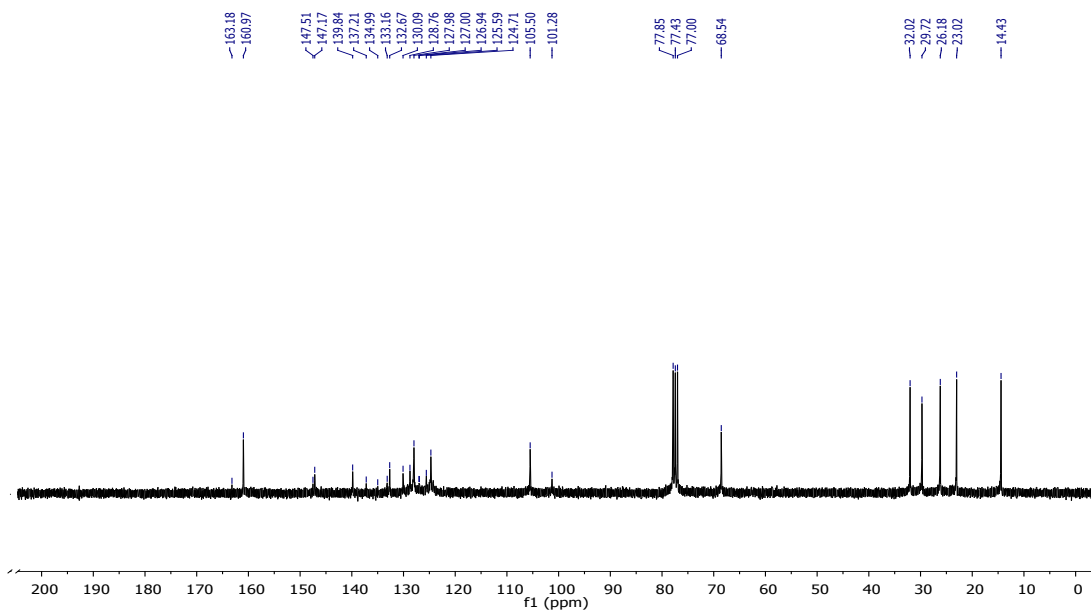
**Figure S3.**  $^1\text{H}$  NMR spectrum of compound AOME



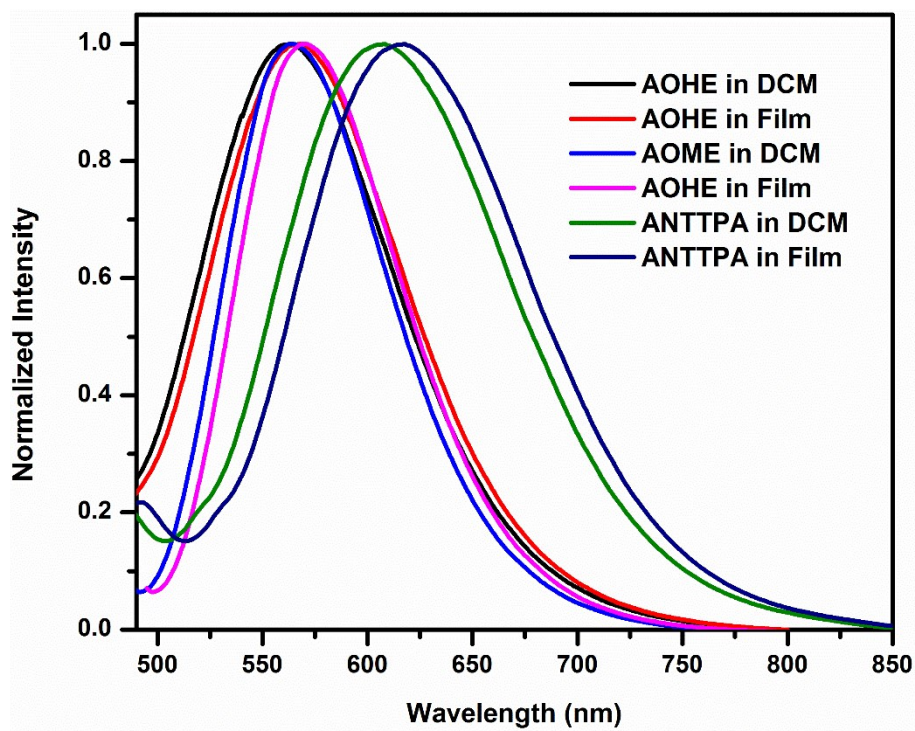
**Figure S4.**  $^{13}\text{C}$  NMR spectrum of compound AOME



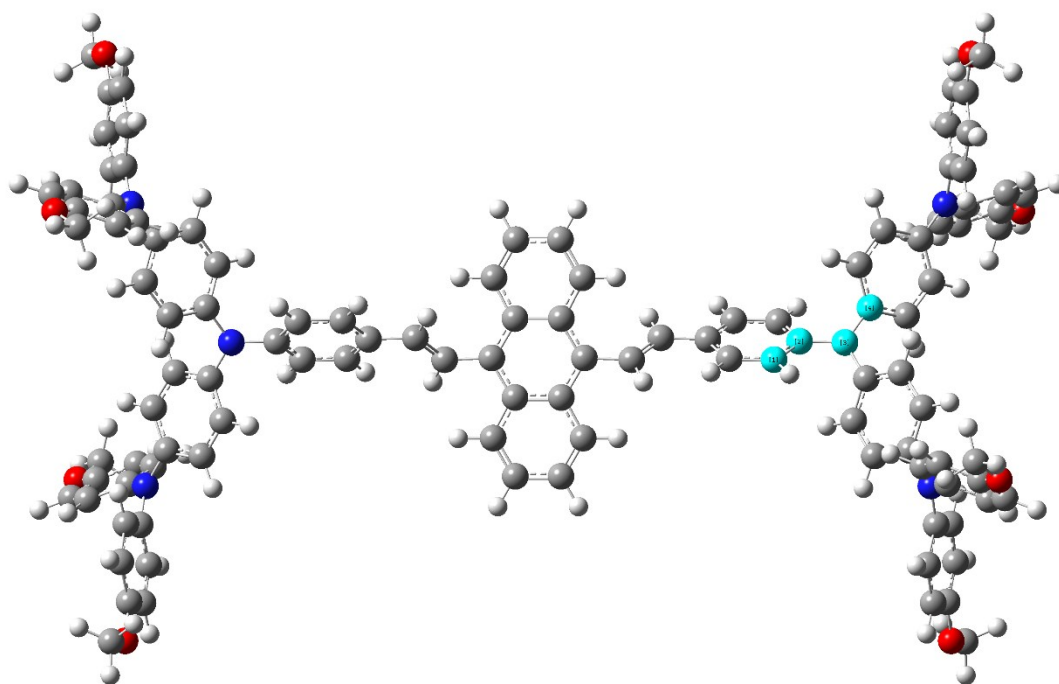
**Figure S5.**  $^1\text{H}$  NMR spectrum of compound AOHE



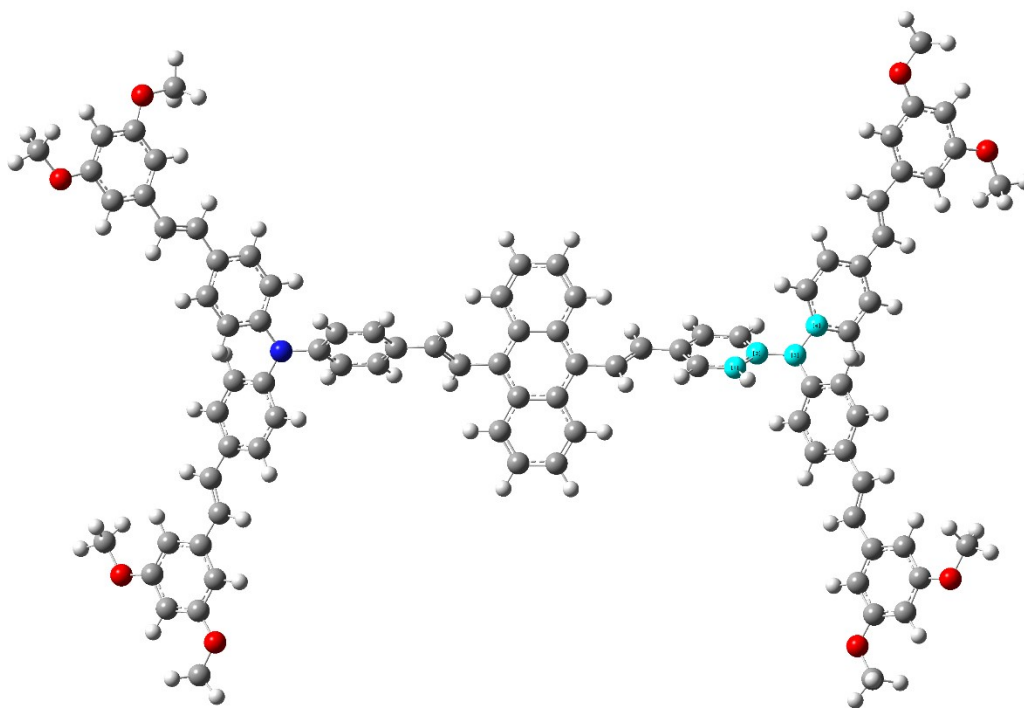
**Figure S6.**  $^{13}\text{C}$  NMR spectrum of compound AOHE



**Figure S7.** Emission spectrum of the synthesized HTMs in both solution and film phases.



**Figure S8.** Dihedral angle display the ANTPA HTM



**Figure S9.** Dihedral angle display the AOME HTM

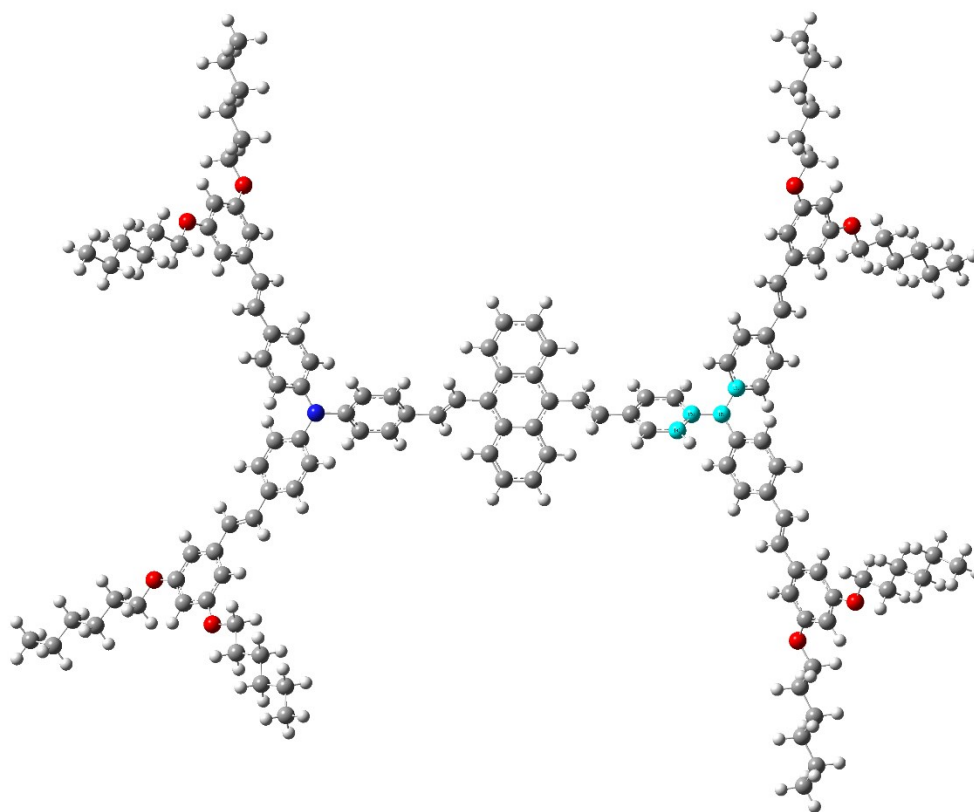


Figure S10. Dihedral angle display the AOHE HTM

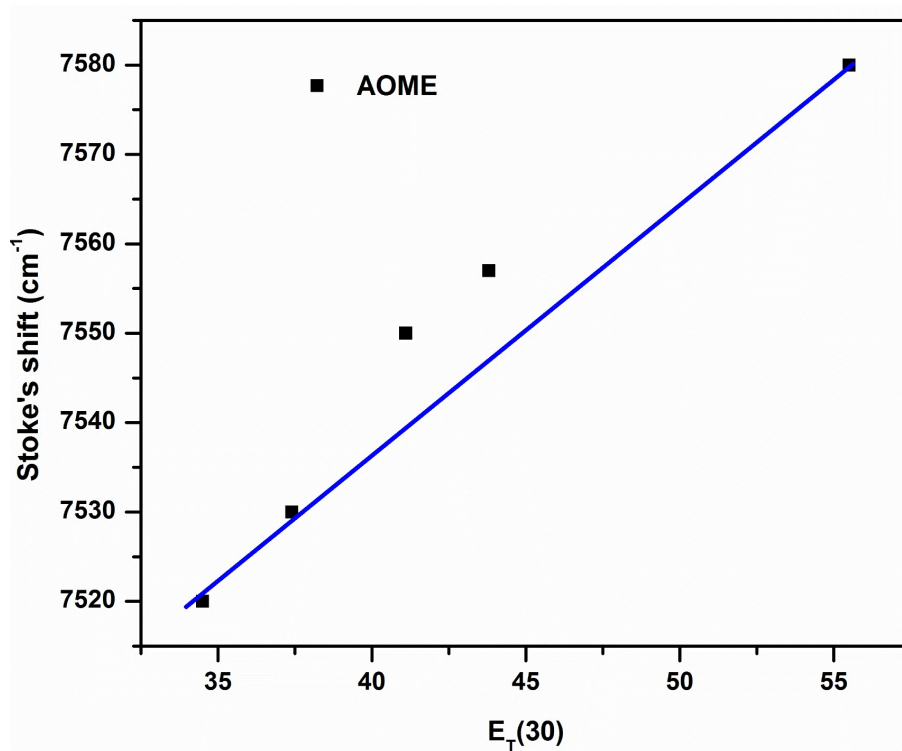


Figure S11. Dimroth–Reichardt solvent polarity correlations for AOME.

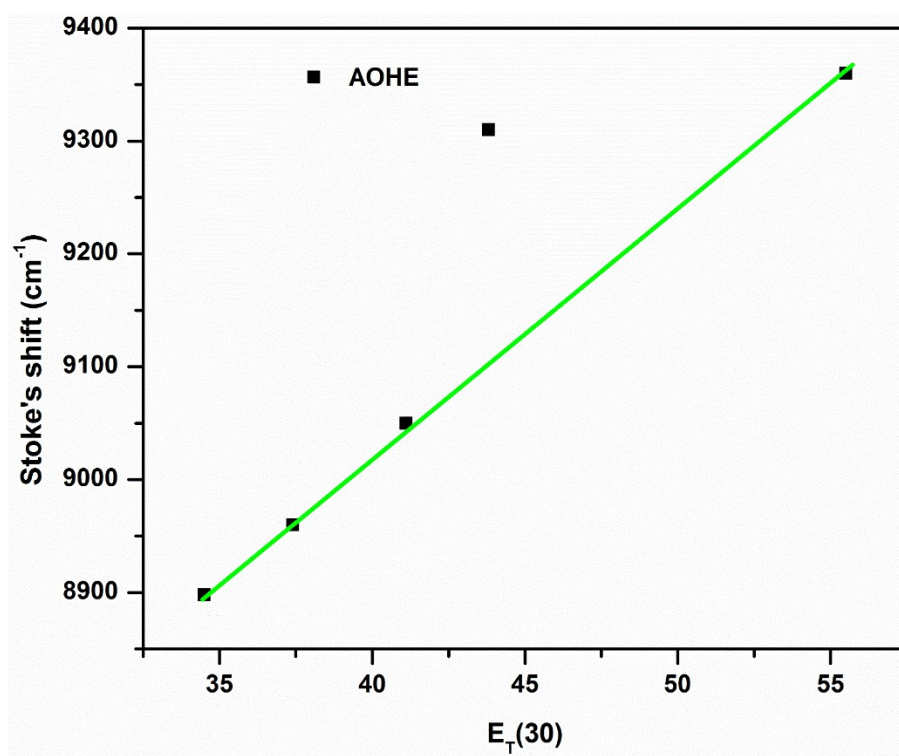
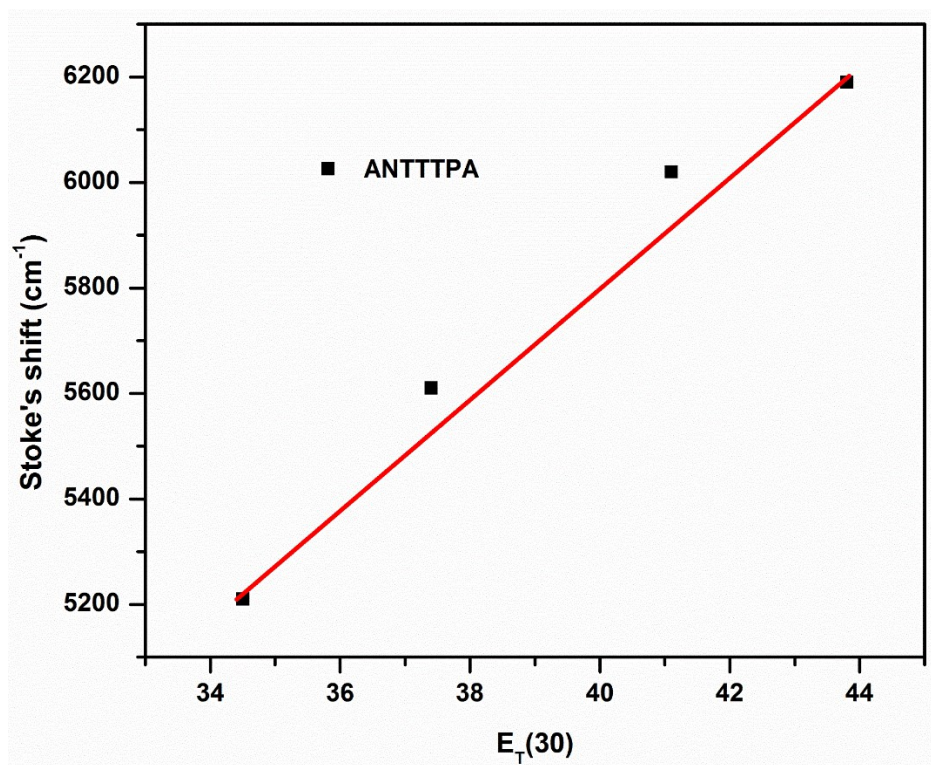


Figure S12. Dimroth–Reichardt solvent polarity correlations for AOHE.





**Figure S13.** Dimroth–Reichardt solvent polarity correlations for ANTTTPA