

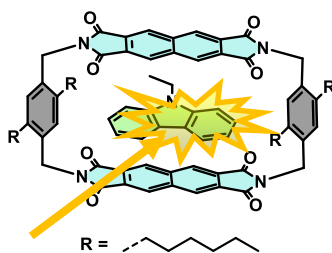
Non-Covalent Approach to harvest delayed fluorescence and phosphorescence in Naphthalene Bisimide Cyclophane

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Organic light emitting diodes (OLEDs) recently received immense attention in the scientific community due to their ability to utilize 100 % exciton theoretically. However, the efficiency of traditional OLED devices is limited to 25 % due to the major loss of 75 % of non-emissive triplet states at room temperature.^[1] In 2012, Adachi's group revitalized the application of Thermally Activated Delayed Fluorescence (TADF) materials, which demonstrated that TADF is an efficient process to harvest non-emissive triplet-state to enhance the internal quantum efficiency (IQE) of OLED devices.^[2] The typical TADF molecules usually involve twisted covalently attached donor-acceptor (D-A) architecture with near orthogonality to decrease the electronic exchange energy (J). However, the supramolecular approach for TADF design can endow TADF emission in the solution state. Herein, utilizing the well-known building block of arylene bisimide, we show the potential of supramolecular strategy to achieve TADF emission in air. The figure below shows the unique character of air-stable triplet states, demonstrating TADF behavior by a non-covalent approach achieved using cyclophane molecular design.



delayed fluorescence lifetime (in air): 0.4 – 1.6 μ s; photoluminescence quantum yield (in air): 5-7 %

Figure 1: Molecular design of supramolecular system to harvest air-stable triplet states by TADF approach.

References:

- [1] Y. Zhang, S. R. Forrest, *Physical Review Letters* **2012**, *108*, 26-29.
- [2] H. Uoyama, K. Goushi, K. Shizu, H. Nomura, C. Adachi, *Nature* **2012**, *492*, 234–238.