A Pentiptycene-Anthracene Hybrid Smart Fluorescent Material

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The photo-responsive fluorescence behaviors (Photomechanofluorochromism and the Photomechanical effect) of a pentiptycene-anthracene hybrid system substituted with a semifluorinated alkoxy chain (abbreviated as F5) were investigated. The demonstrations of organic vapor detection and multicolor fluorescence drawings with F5 were also performed. The yellow excimer fluorescence of the crystals of F5 was switched to blue monomer fluorescence during irradiation. This phenomenon indicates that the formation of the photodimers of F5 (formed from [4+4] photodimerization of anthracene) exerts mechanical stress on nearby supramolecular pairs, causing excimer-to-monomer switching. In addition, the needle-shaped F5 crystals underwent bending away from the light source during irradiation. We believe that the [4+4] photodimers require larger space and cause uneven lengthening of the crystal. This is a characteristic of photomechanical behavior. F5 crystals prior to grinding showed no fluorescence change upon addition of organic molecules, however, after grinding, the amorphous F5 powder (showing blue monomer emission), responded to many organic vapors. Multicolor drawings were developed based on these fluorochromism behaviors. Polymer films of F5 in poly(3,4-ethylenedioxythiophene) : polystyrene sulfonate (ratio 1:6) were also prepared and tested. The photo-responses of F5 in the polymer films were similar to that in the amorphous powder. This can be attributed to the presence of the supramolecular pairs of F5 inside the film. This would facilitate its application in devices such as sensors and data storage devices. The pentiptycene-anthracene hybrid F5 showed promising photo-responsive behaviors. It has potential applications in security devices and Photoactuators.

Awards Won:
Third Award of $1,000