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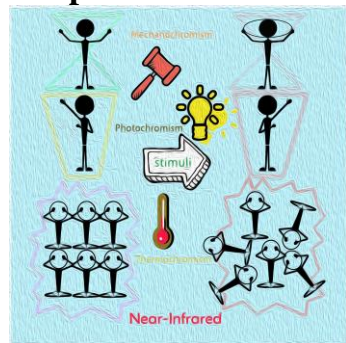
Review

Stimuli-responsive organic chromic materials with near-infrared emission

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Graphical Abstract



Some organic chromic materials responding to external stimuli, mainly to mechanical forces, with a near-infrared (NIR) emission are discussed. In line with reported cases, there is a conclusion that subtle changes in conformations and packing modes are the primary elements contributing to the optical properties changes.

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ABSTRACT

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Organic chromic materials that respond to external stimuli, especially in the solid state, have sparked extensive interest owing to their potential use as smart materials. In particular, the availability of chromic materials, which emit fluorescence or phosphorescence in the deep penetrating, near-infrared (NIR) region, has led to great improvements in imaging. Various methods that were commonly applied to construct chromic materials, have been reformed to develop the novel type of compounds, and some have received rewards with excellent findings. Relevant research achievements of practical applications have showed their potential with the changes that locate in the NIR region, while further in-depth explorations about the inherent chromic chromism are underway. In this review, several representative studies, which have led the development of responsive organic chromic materials with near-infrared emission, will be discussed.

1. Introduction

Functional materials have become very important in the study of life processes. Over the past decade, a wide variety of novel chromic materials comprised of organic fluorescent compounds have been developed and applied in the construction of sensors [1-5], safety devices [6], and imaging [7-12] and optoelectronic systems [13,14]. Most of these luminescent materials display versatile optical responses to different external stimuli with color changes from one to another or between emerging and disappearing, and as a result, they are useful for translating macroscopic natural phenomena like mechanical force, heat, light, electricity and chemical processes into optical changes [15-19]. For the most part, these materials have been designed to emit fluorescence or phosphorescence in the UV or visible regions so that it can be observed using readily available instrumentation or the naked eye. In contrast, very few studies have described photoluminescent materials that emit long wavelength light in the near-infrared (NIR) region despite the fact that materials of this type would have potential applications in systems for highly sensitive and optical bioimaging and biomolecule detection [20-25]. Notably the NIR region here is referring to NIR-I which defines from 740 nm to 1000 nm, and the following samples displayed are selected for their emission bands covering the NIR region, not only with the maximum emission peak locating at the region.

Aggregation induced emission (AIE), described originally by Tang, is a phenomenon in which planar organic compounds display highly efficient light emission in their crystalline and aggregated states [26]. The advent of AIE has opened the new door to the discovery of new solid fluorescent materials.

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