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Photosalient Effect: Dramatic conversion of light into mechanical motion

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Materials showing mechanical response in presence of external stimuli are of relevance for the design of nanoscale actuating devices for a variety of small-scale applications including actuators, flexible electronics, artificial muscles, and others. In recent years, molecular actuators[1] (molecular rotor, elevator, etc.) and several macroscopic systems based on liquid-crystal elastomers, gels, and other polymers[2] have been developed. The most recent efforts are aimed at achieving rapid, reversible, maximum and fatigueless response with single crystals which display optimum coupling between light and the mechanical energy. When exposed to light, certain single crystals can jump up to thousands times their own size. The term "photosalient" was introduced recently to describe this phenomenon.[3] The photosalient effect in the motile crystals represents a direct and visually impressive demonstration of the conversion of light into mechanical motion through a photochemical reaction on a macroscopic scale, which sets the platform for the design of fast biomimetic and technomimetic actuating materials that can mimic animal motions, dynamics of macromolecules, or dynamic technical elements, in the future. In this presentation, we will describe the mechanical response from photosalient single crystals that undergo photoinduced linkage isomerization. To understand the mechanistic details, the mechanism of the process was studied by X-ray photodiffraction, kinematic analysis, IR spectroscopy and mechanical characterization. In contrast to many other solid-state transformations that involve nucleation and propagation of the reaction interface, in this system the reaction proceeds homogeneously whereupon solid solutions form without apparent phase separation.

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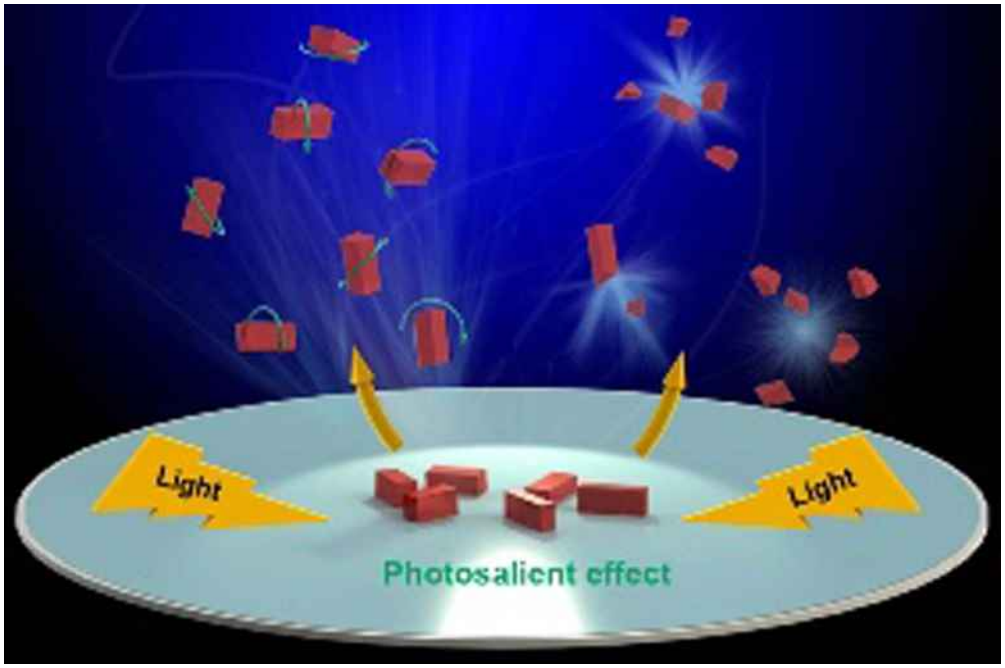

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