Poster Presentation

MS066.P10

Light induced mechanical effects displayed by organic molecular crystals

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Molecular crystals that can bend, curl, twist, spin, leap or blast upon photoexcitation are an emerging subject in the solid-state chemistry research. Among these photomechanical phenomena, the photosalient effect[1,2] is a collective term for sudden light-induced acts of locomotion whereby crystals leap many times their own size. Unlike photoinduced bending, which was reported with crystals of the main photochemical classes (azobenzenes, anthracenes, diarylethenes, furylfulgides), the photosalient effect is an extremely rare phenomenon; since the first documented example of the effect in crystals of α-santonin, only a handful of examples have been reported that include photochemical processes such as linkage isomerism, electrocyclizations, and [2+2] cycloadditions.

3-benzylidenedihydrofuran-2(3H)-one (BDHF) is an organic material which can undergo E ↔ Z isomerization as well as [2+2] dimerization. When exposed to UV excitation single crystals of this material revealed various mechanical responses where some crystals did not display any visible mechanical effects even at high excitation power, others visibly bent or burst violently. This presentation will focus on the macroscopic observation of these phenomena in regard to the type of mechanical response and its relation to the crystal structure. In addition to these irreversible photomechanical effects, the reversible photomechanical bending of the molecular crystals of an azobenzene dye Disperse Red (DR1) and quantification of the bending and unbending process will be described. Detailed kinematic analysis of the crystal bending revealed that the bending follows a monoexponential function whereas unbending process involves a bi-exponential function.[3]

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Keywords: Photosalient effect, Photomechanical bending, Molecular Crystal