Photothermally driven actuation of anisole crystals

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Mechanical crystals, which exhibit macroscopic motions by light and heat, are expected to be applicable for actuators and soft robotics.[1] Over the past decade, we have developed many mechanical crystals based on photoisomerization,[2] thermal phase transition,[3] and the photo-triggered phase transition.[4] Last year, we have firstly found mechanical crystals based on photothermal effect.[5] Photothermal effect can focus on most crystals that absorb light for mechanical crystal development. The crystal of 2,4-dinitroanisole (**24DNAN**) (Figure 1a) in the metastable form has the relatively large thermal elongation coefficient along the *a*-axis,[6] therefore expected to exhibit the large bending by the photothermal effect. Here, we report the photothermally driven bending of **24DNAN** crystals.

The rod-like **24DNAN** crystals were obtained by the fast cooling of saturated methanol solutions. X-ray crystallographic analysis confirmed that the crystal belonged to the space group $P2_1/n$ with one independent molecule, which was metastable. Single crystal X-ray diffraction at 20, 40, and 60 °C revealed that the rod-like crystal had the longitudinal direction along the *a*-axis with the relatively large thermal elongation coefficient (2.7×10^{-4}/°C). Upon UV light (365 nm) irradiation, the rod-like crystal (length 2452 μm, width 87μm, thickness 43.5 μm, Figure 1b) bent down very quickly to 0.45° in 7 ms due to the photothermal effect. After stopping UV irradiation, the rod-like crystal returned to its initial shape in 8 ms (Figure 1c). In this conference, the detail mechanism of photothermally driven bending of **24DNAN** crystals will be presented based on thermal conduction.

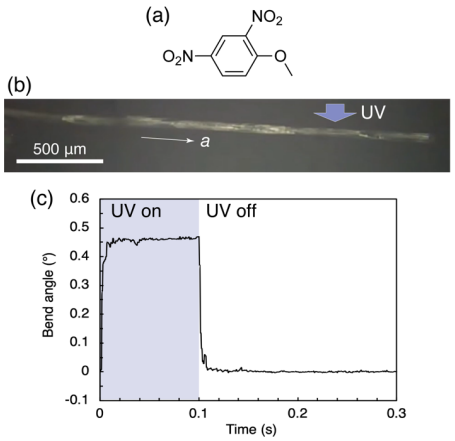

Figure 1 (a) Molecular structure of **24DNAN**, (b) the rod-like **24DNAN** crystal, and (c) the time profile of the photothermally driven bending upon and after UV light irradiation.

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