Photoinduced swing of a diarylethene thin broad sword shaped crystal

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We report a swinging motion of photochromic thin broad sword shaped crystals upon continuous irradiation with UV light. The bending and swinging mechanism are in fact due to the molecular size changes as well as the phase transitions. The first slight bending away from the light source is due to the photocyclization-induced surface expansion, and the second dramatic bending toward the UV incidence is due to the single-crystal-to-single-crystal (SCSC) phase transition from original phase I to phase II_{UV}. Upon visible light irradiation, the crystal returned to phase I. The similar SCSC phase transition with similar volume decrease occurred by cooling the temperature (phase III_{temp}). For both photoinduced and thermal SCSC phase transitions, the symmetry of the unit cell is lowered; in the phase II_{UV} the twisting angle of disorder phenyl group is different between two adjacent molecules, while in phase III_{temp}, the population of phenyl rotamer is different between adjacent molecules. In case for phase II_{UV}, we found thickness dependent photosalient phenomena. The thin broad sword shaped crystals with 3 μm thickness showed no photosalient phenomena, whereas photoinduced SCSC phase transition occurred. In contrast, large crystals of several tens μm thickness showed photosalient phenomena on the irradiated surface where SCSC phase transition occurred. The result indicated that the accumulated strain, between isomerized and non-isomerized layers, gave rise to photosalient phenomenon.

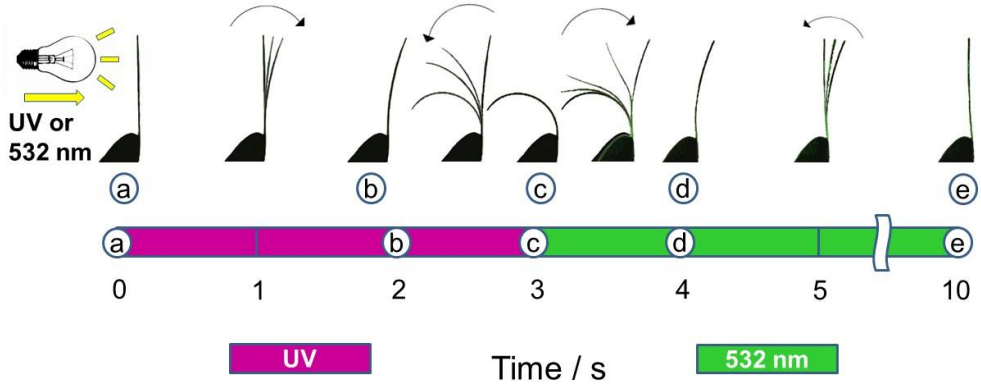

Figure 1. Photoinduced swing motion of a diarylethene thin broad sword shaped crystal.

[1] A. Fujimoto, N. Fujinaga, R. Nishimura, E. Hatano, L. Kono, A. Nagai, A. Sekine, Y. Hattori, Y. Kojima, N. Yasuda, M. Morimoto, S. Yokojima, S. Nakamura, B. L. Feringa, K. Uchida, *Chem. Sci.*, **2020**, *11*, https://doi.org/10.1039/D0SC05388Ks.