Poster Presentation

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Single Crystal in Motion: An Insight into the Mechanism of Actuation

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Dynamic materials that can rapidly transform one form of energy into another have recently attracted attention because they could be utilized as platform for actuation from the nanoscale to the macroscale. This rapidly expanding field has brought up an increasing number of examples of oftentimes serendipitous observations of macro-, milli- and nano-sized single crystals that can hop, bend, curl or twist when exposed to light, heat or external pressure and have the capability to induce motion of other objects. Among these biomimetic crystalline actuators, the so-called thermosalient (TS) crystals, when heated or cooled, exhibit spectacular macroscopic motility as a result of fast coupling of thermal energy with mechanical actuation (Figure 1). Some of these crystals are exceptionally robust and undergo mechanical actuation for several cycles without disintegration. Achieving concurrently fast and reversible actuation of molecular crystals remains a great challenge since mechanical reconfiguration of single crystals is generally accompanied by loss of integrity (cracking, fracturing, explosion, etc.), a serious pitfall that limits their compatibility with the basic requirements for applications as dynamic modules. Despite the potential importance of these biomimetic crystalline actuators as smart materials, the detailed mechanism of actuation and shape change is not understood well. Here we report systematic investigation of the mechanism of mechanical response of these crystalline materials with the aid of single crystal X-ray diffraction, powder X-ray diffraction using synchrotron radiation, and other advanced instrumental techniques.

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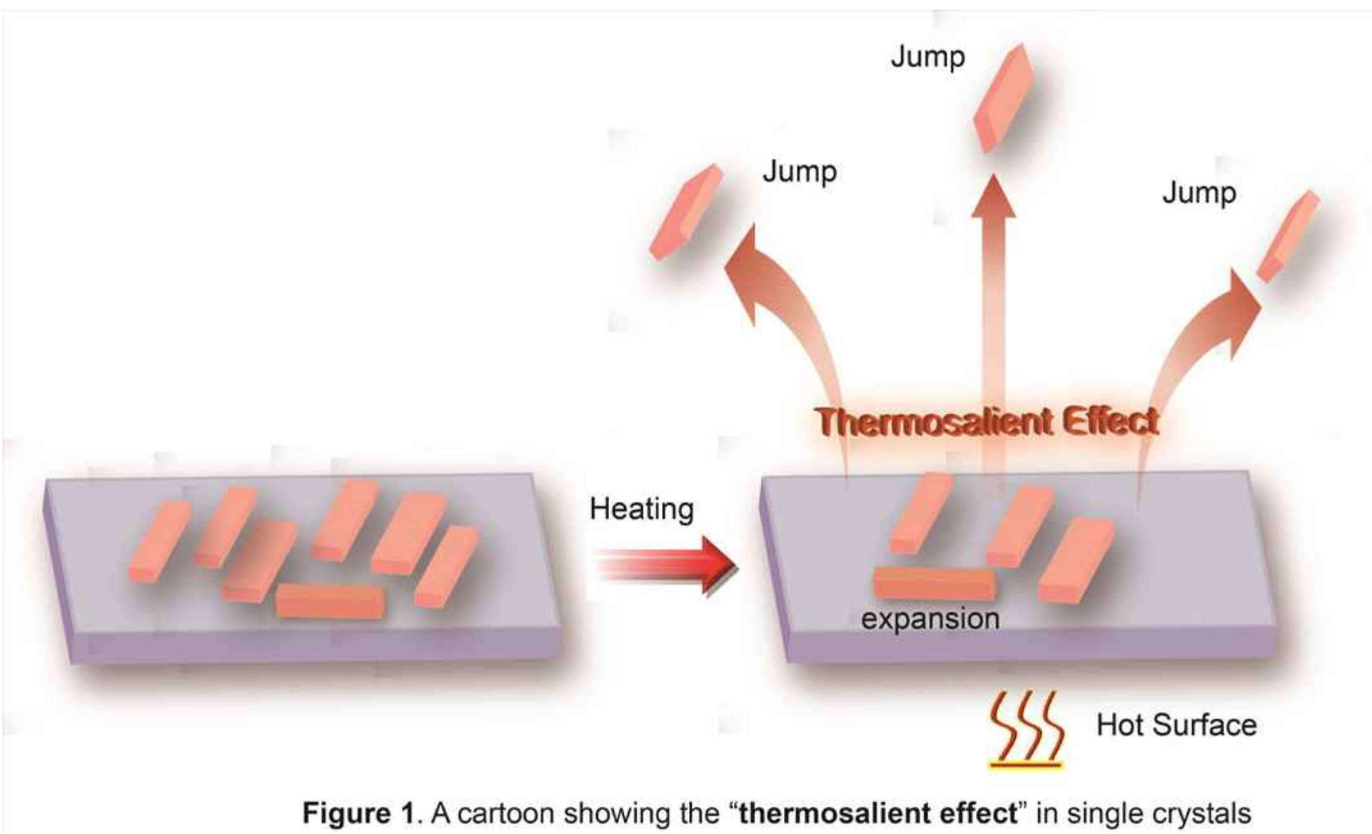

Figure 1. A cartoon showing the "**thermosalient effect**" in single crystals

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