

Novel crystal compound melts under ultraviolet light

May 16 2023

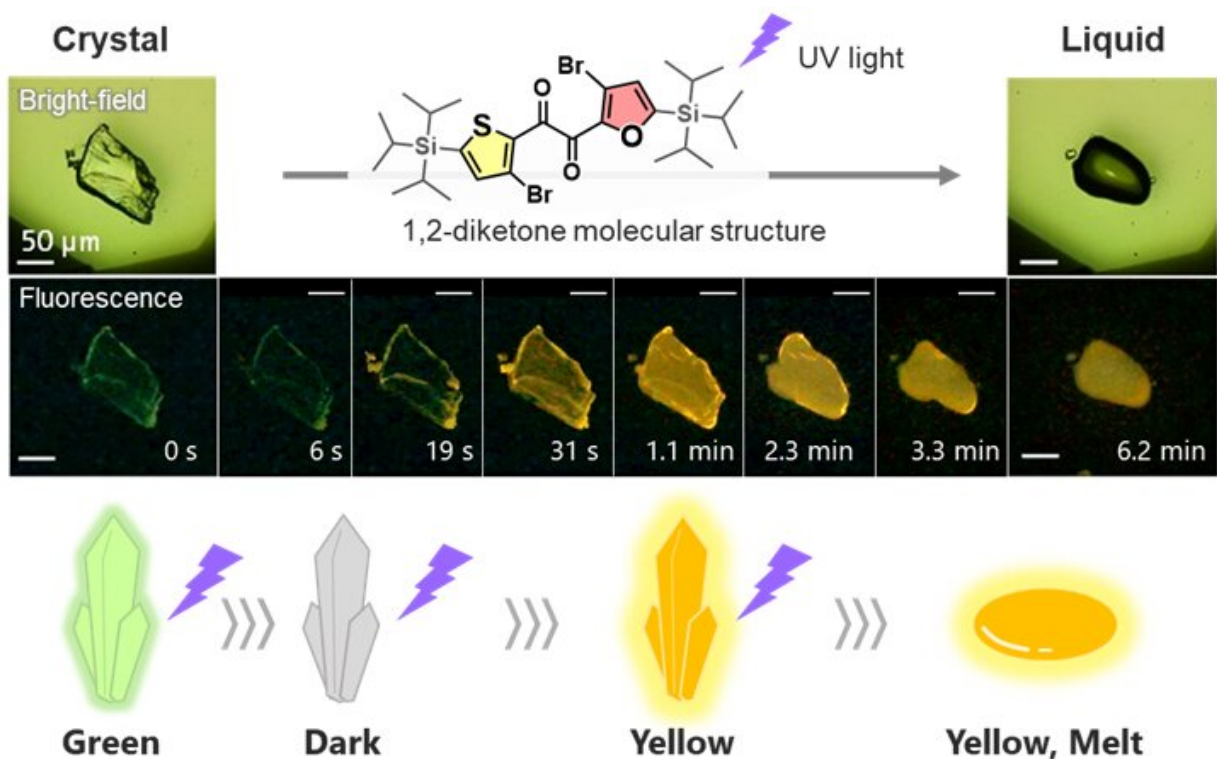


Photo-induced crystal melting with luminescence evolution. Credit: Yosuke Tani

While many materials melt when heated, researchers from Japan recently discovered a novel material in which melting can be induced by ultraviolet light instead of heat. Even more intriguing, this material exhibits changes in its luminescent properties while it melts. This

material is the first organic crystalline material found to show changes in luminescent color and intensity upon ultraviolet light-induced melting.

Investigators from Osaka University reported their discovery of this new class of photo-responsive crystal compounds, "heteroaromatic 1,2-diketones," in *Chemical Science* on April 20. Light irradiation causes the [crystals](#) in these [materials](#) to melt, a phenomenon termed photo-induced crystal-to-liquid transition (PCLT).

This phenomenon can dramatically change a material's properties and makes possible a broad range of applications, for example, photo-responsive, reversible adhesives that could be controlled by light. Few materials have been shown to have this crystal-melting property; hence, the discovery of a new class of PCLT materials is a great step forward in this field.

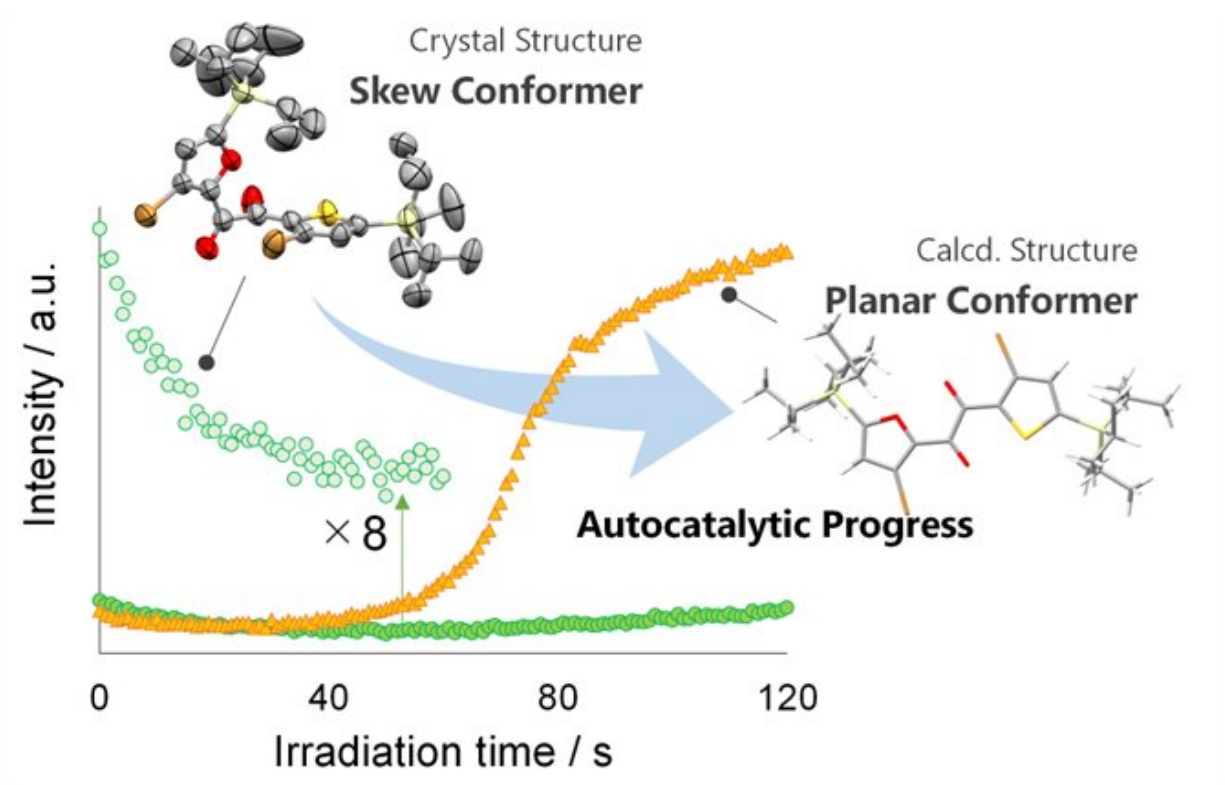
In characterizing their newly discovered class of PCLT materials, the researchers found that one member of this class, the diketone SO, shows changes in luminescence during the irradiation-induced melting process. "This is the first organic crystal we know of that exhibits a luminescent evolution during crystal melting, showing changes in intensity and color, from green to yellow," says lead author Mao Komura.

These changes in luminescence, i.e., changes in the way the material absorbs and emits light, indicated that SO was undergoing molecular-level changes in shape during the PCLT process. Building upon past research on luminescent molecules, the research team realized they could further investigate these molecular-level changes underlying PCLT to better understand the crystal-melting phenomenon.

"We found that the changes in luminescence arise from sequential processes of crystal loosening and [conformational changes](#) prior to melting," explains senior author Yosuke Tani. "These visual indications

of the steps of the PCLT process enabled us to advance the current understanding of crystal melting at the molecular level."

By applying single-crystal X-ray analysis, thermodynamic property analysis, and theoretical calculations to probe the mechanisms governing the behavior of this new PCLT material, the researchers demonstrated that a disordered layer in the crystal is a key factor for PCLT in this class of materials.



Autocatalytic conformation change. Credit: Yosuke Tani

This discovery of a novel PCLT material, along with its characterization, provides fundamental insights into the mechanism of crystal melting and

will enable [greater opportunities](#) for designing PCLT materials with a variety of applications, including photolithography, thermal energy storage, and light-induced adhesion.

More information: Mao Komura et al, Photoinduced crystal melting with luminescence evolution based on conformational isomerisation, *Chemical Science* (2023). [DOI: 10.1039/D3SC00838J](https://doi.org/10.1039/D3SC00838J)

Provided by Osaka University

Citation: Novel crystal compound melts under ultraviolet light (2023, May 16) retrieved 20 April 2024 from <https://phys.org/news/2023-05-crystal-compound-ultraviolet.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.