MS066.O01

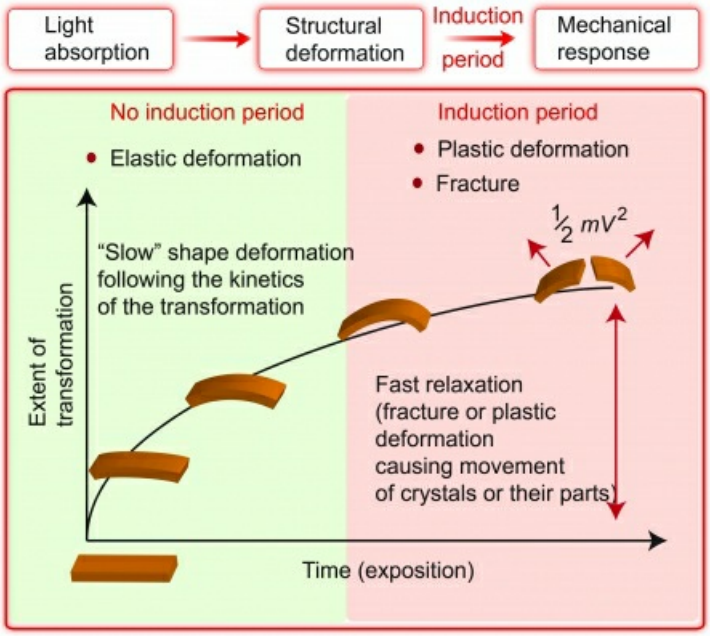
Disintegrative vs Restorative effects during motion and self-healing of crystals

Pance Naumov[1]
[1]*New York University Abu Dhabi, Abu Dhabi, United Arab Emirates*
E-mail: pance.naumov@nyu.edu

One of the most inevitable limitations of any material that is exposed to mechanical impact is that they are inexorably prone to mechanical damage, such as cracking, denting, gouging or wearing. To confront this challenge, the field of self-healing polymers has developed materials that are capable of autonomous self-healing and recover their macroscopic integrity similar to biological organisms. However the study of this phenomenon has mostly remained within the soft materials community and has not been explored by solid-state organic chemists.

There is now in increasing number of oftentimes serendipitous, and sporadically reported observations of single crystals that can hop, leap, bend, curl, crawl, expand, contract, twist, spin, explode, split, roll, or respond otherwise to external stimuli, and many of these motions resemble the behavior of soft, mesophasic materials. These motions of dynamic molecular single crystals represent extreme and visually impressive cases of the mechanical strain that can accumulate in the interior of molecular crystals and be released as mechanical energy. From the viewpoint of the basic structural research, they are also precious model systems that provide the basis to examine the link between the collective force of the intermolecular interactions and their macroscopic response. At the current stage of the understanding of the relations between the structure and mechanical properties, the type in these mechanical effects is hardly predictable, but it almost always is a result of the interplay of disintegrative and restorative factors. This talk will discuss the factors that determine the mechanical effect, and will focus to the newest addition to the dynamic solids, the self-healing of molecular crystals, which are capable of partial restoration of crystal integrity using dynamic covalent chemistry.

[1] Naumov, P. et al. (2015) Chem. Rev. 115, 12440-12490.
[2] Commins, P. et al. (2016) Chem. Commun. 52, 13941-13954.
[3] Commins, P. et al. (2016) Angew. Chem. Int. Ed. 55, 13028-13032.



Keywords: mechanical effects, bending crystals, self-healing materials