Crystals that can self-heal

Panče Naumov

[1]Smart Materials Lab, New York University Abu Dhabi, PO Box 129188, Abu Dhabi, UAE. [2]Center for Smart Engineering Materials, New York University Abu Dhabi, PO Box 129188, Abu Dhabi, UAE. [3]Research Center for Environment and Materials, Macedonian Academy of Sciences and Arts, Bul. Krste Misirkov 2, MK–1000 Skopje, Macedonia. [4]Molecular Design Institute, Department of Chemistry, New York University, 100 Washington Square East, New York, NY 10003, USA

pance.naumov@nyu.edu

Self-healing is an intrinsically exciting concept as it applies to the process of recovery, an almost commonplace effect found in living organisms, and extends to inanimate objects. Self-healing of artificial materials is as beneficial as it is to living creatures, as the effect significantly prolongs the lifetime of both. Self-healing polymers, cementitious materials, and coatings have already found commercial applications. Self-healing of crystals was first discovered in sodium chloride in 1980. However, the field has recently entered a renaissance when it was observed for the first time in the emerging material class of molecular crystals in 2016. The reinvigoration of interest in self-healing molecular crystals stems from their prospects as durable, lightweight, and flexible emissive or electronic materials. As ideally defectless and ordered media, organic crystals have unique optical, mechanical, and electrical properties, and the possibility of self-healing substantially increases their viability for durable, lightweight smart devices.

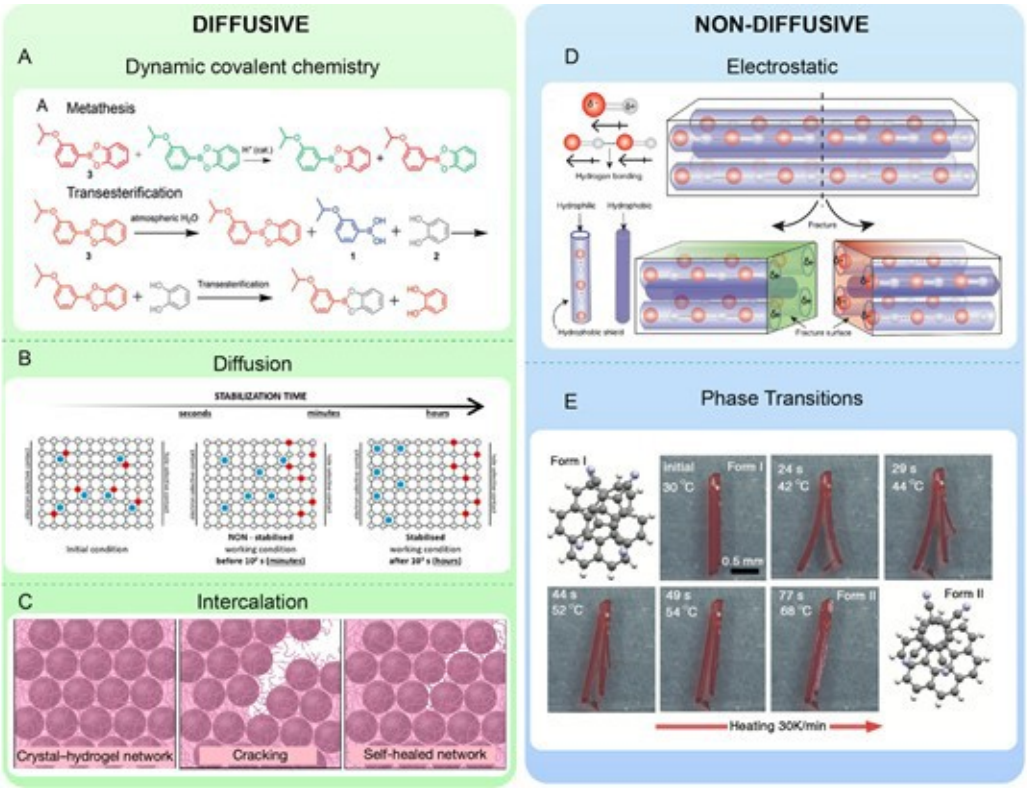

Figure 1. Self-healing in crystals can occur through both diffusive and non-diffusive mechanisms. Diffusive mechanisms such as dynamic covalent chemistry, intercalation, and diffusion require material to migrate to heal a broken interface. Non-diffusive interactions such as electrostatic and phase transitions do not necessitate mass migration, and broken crystals have a snap-together-like property.