New Form Of Hybrid Materials

Tech ID: 29919 / UC Case 2018-096-0

BACKGROUND

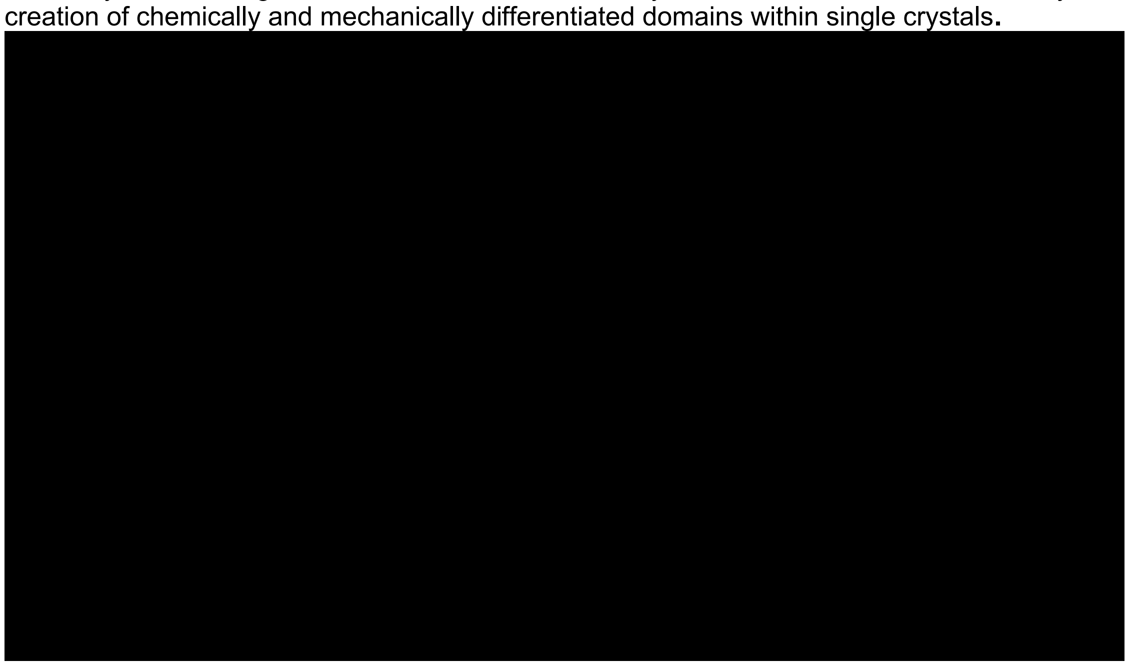
Advances in science are driven by new discoveries which can pave the way to new create new research directions. For example, crystals by the nature of their order in three-dimensional space, cannot flex or expand, but with the integration of macromolecular ferritin crystals with hydrogel polymers can change their dimensions.

TECHNOLOGY DESCRIPTION

Researchers from UC San Diego have developed a new form of materials that integrate macromolecular protein crystals with synthetic polymer networks. These hybrids seamlessly combine the structural order and periodicity of crystals, the adaptiveness and tunable mechanical properties of polymeric networks and the chemical versatility of protein building blocks.

Additionally, the ability to reversibly expand–contract crystal lattices and mobilize their protein components may provide a new means to explore otherwise inaccessible protein structural states using three-dimensional protein crystallography. Protein crystals are often highly porous, sometimes containing up to 90% solvent, and are usually assembled through weak, non-covalent packing interactions; therefore, this invention should be applicable to other protein lattices.

More specifically, these unique macromolecular ferritin crystals with integrated hydrogel polymers can isotropically expand to 180 per cent of their original dimensions and more than 500 per cent of their original volume while retaining periodic order and faceted Wulff morphologies. Dynamic bonding interactions between the hydrogel network and the ferritin molecules endow the crystals with the ability to resist fragmentation and self-heal efficiently, whereas the chemical tailorability of the ferritin molecules enables the creation of chemically and mechanically differentiated domains within single crystals**.**



APPLICATIONS

This technology has the potential for generalizability, coupled with the chemical tailorability of synthetic polymers and the genetic mutability of proteins, should make protein crystal–hydrogel hybrids a rich medium for materials science.

- Novel adaptive/flexible yet ordered materials to be used in sensing, separation,catalysis, actuation applications.
- Improved protein crystallography strategies.

ADVANTAGES

- Allows crystals - which are typically rigid and brittle - to expand and contract reversibly.
- The incorporation of polymers increases the mechanical toughness of the crystals and allows them to self-heal (self-healing is exceedingly rare in molecular crystals).
- The ability to reversibly expand/contract crystal lattices and mobilize the protein components therein may provide a new means to improve X-ray diffraction quality and explore otherwise inaccessible protein structural states using 3D protein crystallography.
- It allows the creation of chemically and mechanically differentiated domains within single crystals.

CONTACT

University of California, San Diego
Office of Innovation and Commercialization
innovation@ucsd.edu
tel: 858.534.5815.

OTHER INFORMATION

KEYWORDS

Materials Design, protein crystallography, reagents, ferritin crystals, hydrogel polymers

CATEGORIZED AS

- **Materials & Chemicals**
  - Biological
  - Chemicals
- **Medical**
  - Delivery Systems

RELATED CASES

2018-096-0

STATE OF DEVELOPMENT

Researchers have experimental data and are working on a prototype.

INTELLECTUAL PROPERTY INFO

This technology is patent pending and available for licensing and/or research sponsorship.

RELATED MATERIALS

- UC San Diego News Center. Chemists 'Crystallize' New Approach to Materials Science. - 05/03/2018
- Zhang L, Bailey JB, Subramanian RH, Groisman A, Tezcan FA. Hyperexpandable, self-healing macromolecular crystals with integrated polymer networks. Nature. 2018 May;557(7703):86-91. doi: 10.1038/s41586-018-0057-7. Epub 2018 May 2. - 05/02/2018

PATENT STATUS

Patent Pending

University of California, San Diego
Office of Innovation and Commercialization
9500 Gilman Drive, MC 0910, ,
La Jolla,CA 92093-0910

Tel: 858.534.5815
innovation@ucsd.edu
https://innovation.ucsd.edu
Fax: 858.534.7345