Self-Healing Elastomers

Tech ID: 25551 / UC Case 2011-880-0

BRIEF DESCRIPTION

The invention is a design of material capable of spontaneous self-repair upon mechanical damage. This material is tough, yet, in contrast with previously reported self-healing substances, it repairs itself into a single-component solid in a truly autonomous manner, without use of heat, light, any other external stimulus, healing agents, plasticizers, or solvent. In addition, the proposed design and synthesis are facile and greatly amenable to tuning of the matter’s mechanical properties. This invention holds great promise for improving the safety, lifetime, energy efficiency, and environmental impact of man-made materials.

FULL DESCRIPTION

It is a greatly desirable property for man-made materials to be capable of imitating nature in its ability to spontaneously heal injury and, thus, increase survivability and lifetime – in sharp contrast, synthetics usually fail after damage or fracture. However, despite significant research efforts, most reported to date self-healing materials require some kind of an external (heat or light) or internal (healing agents) stimulus. Alternatively, the ease of self-healing might be gained from surrendering material’s mechanical strength and stiffness, as in the cases of substantially solvated soft gels or plasticized rubbers. Nevertheless, the synthesis of a hard material with intrinsic self-healing ability has been elusive.

The researches at UCI have now developed a strategy to obtain stiff materials that can spontaneously repair themselves after mechanical damage. These materials are multiphase supramolecular thermoplastic elastomers that combine high modulus and toughness with completely autonomous healing capability even in ambient environment. Furthermore, no heat, light, healing agents, solvent, plasticizer, or any other additives are necessary for repair activation. The material’s highly advantageous properties originate from the clever design inspired by nature and rely on hydrogen-bonded brush polymers that are, in turn, self-assembled into a hard–soft microphase-separated system. The overall structure, thus, combines the enhanced stiffness and toughness of nanocomposites with the self-healing capability of soft dynamic supramolecular assemblies. In addition, the proposed approach offers versatility in tuning the structures and properties of the substance allowing for a wide range of mechanical properties.

SUGGESTED USES

Design and synthesis of self-repairing materials with a wide range of mechanical properties to improve safety, lifetime, energy efficiency and environmental impact of man-made products

ADVANTAGES

Truly and completely autonomous self-healing process, self-repair proceeds in ambient environment without any energy input or additives

PATENT STATUS

Country	Type	Number	Dated	Case

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OTHER INFORMATION

CATEGORIZED AS

- **Materials & Chemicals**
  - Chemicals
  - Composites
  - Polymers

RELATED CASES

2011-880-0

United States Of America	Issued Patent	9,938,368	04/10/2018	2011-880

STATE OF DEVELOPMENT

Proof of concept published in a very high impact peer-reviewed journal (Nature Chemistry)

RELATED MATERIALS

» Multiphase design of autonomic self-healing thermoplastic elastomers

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