A New Class of Self-healing Polymers: Polymeric Metal-Organic Cages (PolyMOCs)

Technology #16872

Applications

- Drug / fragrance / pollutant encapsulation
- Controlled release
- Separations / chromatography
- Water purification / filtration

Problem Addressed

Polymer networks and gels typically have very different properties compared to crystalline metal-coordinated assemblies. This technology from the Johnson lab presents a new polymer class that merges the properties of traditional hydrogels with metal-coordinated cages to provide gels with self-healing and selective uptake and release properties.

Technology

Many polymer materials are structurally stable until they encounter some form of large mechanical strain. Following extreme deformation, such polymers lose their utility. This new invention from the Johnson lab presents a polymer class that combines the material stability of polymer networks like hydrogels or rubber with self-healing properties derived from metal-ligand self-assembly. Importantly, cage-like assemblies are formed that lead to a novel porous material architecture.

The self-healing properties of polyMOCs arise from special interactions between the many telechelic polymers that compose the materials. A telechelic polymer here refers to a polymer that has the same functional group on each of its ends. In the case of a polyMOC, telechelic polymers have ligands on the end of each polymer chain, and these ligands possess a binding affinity to certain metal ions. Due to thermodynamic favorability, these ligands coordinate around the metal ion with a controlled geometry, driving the junctions to self-assemble into muli-metal, multi-ligand clusters of defined 3D nano-scale geometry. The spontaneous formation of an organized network can be tuned to form unique three-dimensional shapes, yielding materials that restore their metal-ligand coordinated shape even when the material is strained or perturbed. The inventors have demonstrated that polyMOC gels can successfully encase doxorubicin, a common therapeutic tumor drug.

Advantages

- Upon exposure to mechanical failure, the material can self-heal to its original conformation
- This material can be used as a novel molecular encapsulation device that can uptake or release compounds over time through its porous architecture. The material can also selectively uptake certain metal ions

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Categories For This Invention:

Materials
Fabrics, Fibers & Textiles
Water Treatment
Life Sciences
Chemicals
Catalysts
Environment
Water Purification
Therapeutics
Drug Delivery

Intellectual Property:

Suprametallogels and uses thereof
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Suprametallogels and uses thereof
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Image Gallery:

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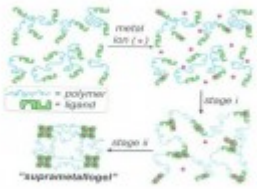

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