Smart Materials Capable of Programmed Shape Change

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BACKGROUND

Nanoparticles capable of reversible changes in morphology in response to specific stimuli are expected to have broad utility in designing targeted drug-delivery, detection strategies, self-healing materials, and templates for hierarchical directed assembly. While there are several elegant examples of stimuli-responsive soft nanoparticles, programmable materials with the requisite shape-change properties remain elusive.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed soft nanoparticle materials that exhibit reversible, stimuli-responsive changes in morphology. In its primary embodiment, the invention leverages the utility of DNA as an informational molecule to design nanoparticles that undergo reversible morphological changes in a DNA-encoded fashion. Utilizing the sequence selective recognition properties of DNA, and its performance as a substrate for selective enzymatic cleavage, the amphiphilicity of a range of surfactants is programmed and tuned. This approach provides unprecedented programmability and reversible control over the morphology of nanoscale objects and allows user-defined selection of particle shapes and sizes. Control over these materials and their utility in detection, reversible uptake/release, and as soft material templates have been demonstrated. Another inventive aspect provides peptide-based enzymatic responsive systems.

APPLICATIONS

The invention has a wide range of biomedical and device applications including phase-change triggered drug delivery, morphology-controlled pharmacokinetics, phase-change activated MRI contrast agents, and biotemplating of materials for nanoelectronics.

INTELLECTUAL PROPERTY INFO

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

RELATED MATERIALS

- Programmable Shape-Shifting Micelles (Angewandte Chemie)
- Smart Lipids for Programmable Nanomaterials (Nano Lett.)

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,040,626	05/26/2015	2010-007

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OTHER INFORMATION

KEYWORDS

programmable materials, smart materials, nanoparticle, nanoparticle chemotherapeutic, DNA, shape change, reversible morphology, drug delivery, contrast agent, biotemplating, micelle, lipid

CATEGORIZED AS

- **Materials & Chemicals**
  - Biological
  - Nanomaterials
- **Medical**
  - Delivery Systems
  - Diagnostics
- **Nanotechnology**
  - NanoBio
- **Sensors & Instrumentation**
  - Biosensors
  - Environmental Sensors
  - Medical

RELATED CASES

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