

Non-Confidential Description - PSU No. 3684
“Biomimetic, Signal-Responsive Plastics”

Keywords:

stimuli-responsive, smart materials, biodegradable plastics, shape memory, coatings

Links:

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Background

Materials having “life-like” qualities have significant commercial potential as smart coatings, textiles, adhesives, bandages, packaging and other applications. Recent advances in materials chemistry have made materials that typically exhibit a single response to a single type of signal.

Invention Description

The subject invention represents a novel class of biomimetic plastics that are both sensitive and specific in their responses. The invention consists of polymers that depolymerize autonomously in response to specific chemical signals in the environment. Once depolymerization is initiated, no further reagents are required to continue the engineered response, for instance to cause the polymers to change shape in a signal-dependent manner. The materials are self-powered (i.e. do not require batteries). Depolymerization may be designed to occur in air, in liquid solutions, or both, depending on the desired properties and uses for the polymer. Importantly, the magnitude of the responses is amplified in relation to the intensity of the applied signal. Signals may include but not be limited to enzymes, small molecules, metals, heat, light, and liquids or bodily fluids such as urine.

Lab-scale prototypes of this invention have been reduced to practice. Sample polymers may be transferred under a Materials Bailment Agreement. Additional development work is being supported by U.S. federal research grants.

Advantages/Applications

The subject invention may find commercial and government applications where life-like response characteristics are more important than long-term structural stability. Examples include but are not limited to reversible adhesives where the adhesive is removed or made ineffective, 2) degradable plastics for military applications or for mass-market consumer uses such as grocery bags, 3) switches for microfluidic, diagnostic, sensor or drug delivery applications, toys and 4) responsive coatings. This technology also opens new approaches to recycling.