BSA-Based Resin for Vat Photopolymerization

This technology offers a bovine serum albumin-based resin for stereolithographic apparatus 3D printing. This method affords bioplastic objects with shape-memory behavior and enables superior mechanical performance.

What is the Problem?

Biosourced materials that can supplant petroleum-based materials are an integral component of sustainability. Moreover, renewable materials with greater complexity and functionality will be required to meet the demands for the full spectrum of applications from aerospace to medicine. Protein-based materials, which include biologically derived proteins, engineered proteins, and polymer−protein conjugates, have been developed to create materials that emulate biological and nonbiological functions, as well as other physical characteristics (i.e., mechanical properties). While there are significant efforts to develop protein-based plastic materials for commercial use, their application is restricted by poor processability into 3D form factors and limitations in mechanical performance. Both 3D and 4D additive manufacturing (AM) processes that utilize vat photopolymerization have tremendous potential in industrial manufacturing for the future production of parts and supplies. While a growing list of elastomers, plastics, and composites have been reported, there are relatively few examples of resins that are biosourced and biodegradable. There has not been a demonstration of a protein-based material that exhibits plasticity due to unfolding, with a corresponding shape recovery back to its original form.

What is the Solution?

The solution is a bovine serum albumin-based resin for stereolithographic apparatus (SLA) 3D printing that affords bioplastic objects with shape-memory behavior. The native conformation of these globular proteins is largely retained in the 3D printed constructs and each protein molecule possesses a “stored length” that could be revealed during mechanical deformation (extension or compression) of the 3D bioplastic objects. While the plastically deformed objects could retain this state for an indefinite period of time, heating the object or submerging in water allowed it to return to its original 3D-printed shape.

What Differentiates it from Solutions Available Today?

Technology ID

BDP 8707

Category

Materials/Polymers
Selection of Available Technologies

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While there are significant efforts to develop protein-based plastic materials for commercial use, their application is limited by poor processability and limitations in mechanical performance. This solution will enable superior mechanical performance and processability into 3D form factors.

Patent Information:

WO2022140333A1

References

1. Eva Sanchez-Rexach, Alshakim Nelson(44287) , https://pubs.acs.org/doi/10.1021/acsami.0c22377, Applied Materials and Interfaces