Protein-Based Resins for Additive Manufacturing

This technology is a methacrylated bovine serum albumin resin for 3D printed structure that are biocompatible and patterned by light. It can be used for hydrogel resins because it is simple to prepare and biodegradable.

What is the Problem?

Stereolithography (SLA) is one type of vat photopolymerization where a laser is scanned to selectively cure a photocurable resin to form a structure. Unlike some other types of 3D printing, SLA provides the ability to achieve micron scale features resulting in high accuracy parts. While capable of producing a structure having high resolution 3D geometry, SLA is greatly limited by the lack of available resins. Hydrogels include crosslinked hydrophilic polymers and are used in a wide range of 3D printing applications including biomedical implants/drug delivery, tissue engineering/cell scaffolds, and soft robotics. Hydrogels are often used in bio-applications because their high-water content mimics an extracellular matrix and provides a suitable microenvironment for cell growth. There are only a few reported resins capable of 3D printing biocompatible hydrogels through vat photopolymerization. However, these can exhibit poor cell adhesion or may be non-biodegradable. New materials specifically for SLA that are biocompatible, biodegradable, and simpler to prepare, are needed to address these issues.

What is the Solution?

The solution is a methacrylated bovine serum albumin (BSA-MA) resin formation and 3D printing process. The method of fabricating 3D printed structures from these biocompatible proteins includes forming a photoreactive, proteinaceous resin, and 3D printing biocompatible structures from the resin by the patterned application of light in a select wavelength to cure the resin into the desired structures. Suitable photoreactive proteinaceous resins can be formed by reacting an aqueous solution of an acrylated or methacrylated globular protein with a photoreactive comonomer or photoinitiator. Structures printed from the photoreactive, proteinaceous resin can be photo-cured and dried to form bioplastic structures.

What Differentiates it from Solutions Available Today?

SLA is limited by the availability of resins. Existing hydrogel resins are limited by the lack of biocompatibility and the inability to biodegrade. Additionally, these hydrogels are difficult and expensive to prepare. This solution is biocompatible, biodegradable, and simpler to prepare than the existing hydrogel resins.

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Category

Materials/Polymers
Selection of Available Technologies

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