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## Direct Metal Printing with Stereolithography

### Background

3D stereolithography (SL) printing is a relatively new scientific phenomenon, enabling the creation of virtually any object from a digital file using additive processes, meaning the object is created by laying down subsequent layers of the material until the desired object takes shape. This technique is highly effective in printing polymeric materials, enabling efficient and precise building of objects.

However, SL printing of metallic structures has not been demonstrated previously, as SL printing has only been shown to be effective with softer materials like polymers and gels. Therefore, it is necessary to develop a technique that enables the utilization of 3D printing to create metallic objects, revolutionizing the way various metallic objects of practical use are manufactured.

### Invention Description

Researchers at Arizona State University have developed a technique of 3D stereolithography printing that involves the production of a metallic object layer by layer in a similar fashion to the layering of polymers common to current 3D printing techniques. The researchers have enabled this development through their creation of the specific chemistries of the metallic precursors – the “inks” – required for effective printing.

The resulting SL printed object is of any arbitrary shape and metallic in nature without need for a template, which was previously possible only through use of costly equipment and under extreme conditions. In addition, this new technique uses chemical interactions to enable the creation of objects that synthesize metallic and non-metallic elements with the model of stereolithographic printing device that already exists.

### Potential Applications

- PC board manufacturing
- Energy storage
- Catalysis
- Soft robotics
- Biochemical sensing

### Benefits and Advantages

- Innovative: Creation of novel “inks” for 3D printing that enable metallic objects to be printed using a traditional 3D printing device
- Cost-Effective: No longer need specific, costly equipment or templates to print metallic objects
- Efficient: Ability to produce objects that are combinations of metals and nonmetals with one single platform
- Precise: Ability to print objects with fine feature sizes, with resolution of up to 10  $\mu\text{m}$