Solid-State 3D Printing of Metals at Room Temperature (#7590)

A tool to electrodeposit layers of a metal compound at room temperature for building three-dimensional geometries

Georgia Tech inventors present a solid-state technology to electrodeposit layers of a metal compound at room temperature for building three-dimensional (3D) geometries. The demonstrated additive fabrication technology exhibits a dispenser-free nozzle as it operates in solid-state phase. Layers of copper are electrodeposited through a solid media on a conductive substrate and the printed pillar is imaged and its material composition characterized by energy dispersive spectroscopy. Since no dispensing mechanism is required, the system complexity is reduced to a level that the use of micro-engineered nozzle in many multiples is possible for parallel 3D printing. Unlike the current metal, the new pump-less, solid-state nozzle exhibits a simple structure that can be employed in multiples to enable parallel printing for batch fabrication. This addresses the inherent challenges with additive fabrication for mass manufacturing and potentially expanding the capacity of 3D printing for rapid prototyping and high volume production. This development not only addresses metal 3D printing constrains but also enables scaling additive fabrication technology for mass manufacturing.

Benefits/Advantages

- Dispense-free nozzle
- Operable with solid-state of metals
- System complexity is reduced
- Enables use of micro-engineered nozzle in many multiples for parallel 3D printing
- Enables high volume production of 3D printed metal geometries

Potential Commercial Applications

- 3D Printing Microelectronics
- 3D Printing Aerospace Industry
- 3D Printing Metal Geometries

Background/Context for This Invention

Building complex geometries and hollow objects using subtractive fabrication techniques faces fundamental

restrictions, such as inaccessible construction planes. Additive manufacturing techniques are used to enable rapid fabrication of complex structures via monolithic fabrication, which is possible even with multiple materials. However, the technique faces challenges with the use of metals, as all 3D printing technologies rely on dispensing a material and operating in liquid phase at high temperatures.

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Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/solid-state-3d-printing-metals-room-temperature