Syntactic Metallic Foams for Functional Grading (2018-002)

Metallic Foams Formed from Lost Foam Casting have Porous Cells that can be Infused with Nanomaterials for Property Enhancement

Market Overview

Metallic foams created with lost foam casting have porous a porous surface which can be impregnated with nano-materials to give the metal new properties, such as reinforced strength or better electrical and/or thermal conductivity. Controlling distribution and porosity of the metallic foam often proves difficult, and functionalization can currently only be applied to the whole metallic foam and not just targeted areas. In 2016, the metal matrix composite market was valued at $460.5 million, and its need continues to grow due to the demand for new thermally efficient and stronger metal materials. Clemson University researchers have developed a method of forming functionally-graded metallic syntactic foams via lost foam casting that allows for functionalization, targeting of specific areas of the metallic foam with a high degree of control.

Application

Specialty metals used for reinforcement and subjected to high temperatures

Stage of Development

Proof of Concept

Advantages

- Fabrication of the metallic structure can target specific areas of the foam, allowing for localized nanomaterial reinforcement.
- Method allows for large-production volumes of metallic syntactic foams, increasing product output and satisfying demand.
- The manufacturing method reduces synthesis of the foam down to a single-step, conserving time and manufacturing costs.

Technical Summary

This technology implements reinforcement of the metal matrix only in locations where enhanced mechanical properties are desired, rather than the entire matrix. The distribution of porosity and nanomaterials incorporated into the surface of the metal matrix is controllable by tuning the morphology of the nanocomposite nanofibers. The morphology of the nanofiber-based pattern deposited on the mold surface is adjusted by the electrospinning process voltage, spinning distance, and precursor solution concentration. Single-step manufacture is achieved by having the molten metal vaporize the expendable polymer nanocomposite nanofiber-based pattern during casting, resulting in formation of porous cavities on the surface, along with transfer of nanomaterials into the metal matrix which were embedded in the pattern.

Country	Serial No.	Patent No.	CURF Ref. Number	Inventor
United States	NA	NA	2018-002	Dr. Hongseok Choi

About the Inventor

Dr. Hongseok Choi is an Assistant Professor in the Mechanical Engineering Department at Clemson University. Dr. Choi received his Ph.D. in mechanical engineering from the University of Wisconsin in 2007. Prior to joining the Clemson faculty, he worked as an assistant scientist in the Nano-Engineered Materials Processing Center (NEMPC) at the University of Wisconsin-Madison. He has published 32 referred journal articles, 28 peer-reviewed conference proceedings, and has invented two patents and seven invention disclosures in progress. Dr. Choi's expertise lies in the nano-processing, micro/nanosensors, ultrasonic joining, laser materials processing, and additive

For More Information

To learn more about this technology, please contact:

Andy Bluvas

Technology Commercialization Officer

bluvasa@clemson.edu

(864) 656-5157