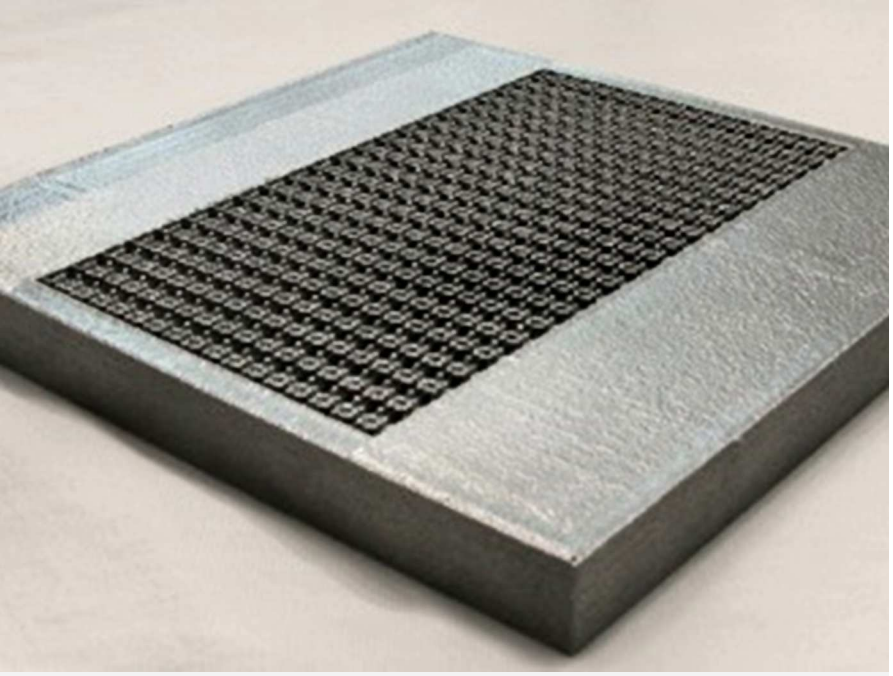


National Aeronautics and Space Administration

Materials and Coatings

Functionally Graded Metal-Metal Composite Structures

Novel process to create unique metallic alloy compositions

NASA Langley Research Center has developed a functionally graded metal-metal composite structure. The structure is created using a method that avoids deleterious reactions between the different metal constituents, as would be observed via conventional melt processing. The results are unique alloy compositions and arrangements not typically available through conventional processing routes.

BENEFITS

- Full control over the macroscopic 3D arrangement of phases in a multi-component alloy system.
- Capability to combine alloys that generally aren't compatible, at least through conventional melt processing operations.

APPLICATIONS

- Pressure vessels
- Tensile fatigue critical structures
- Ballistic impact resistant structures
- Metallic glass alloys
- Acoustically tailored metallic alloys

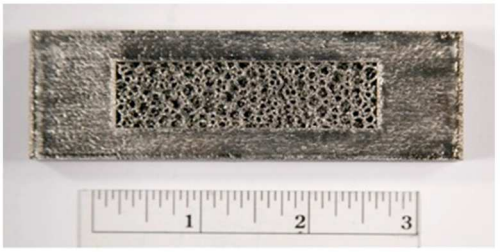
technology solution

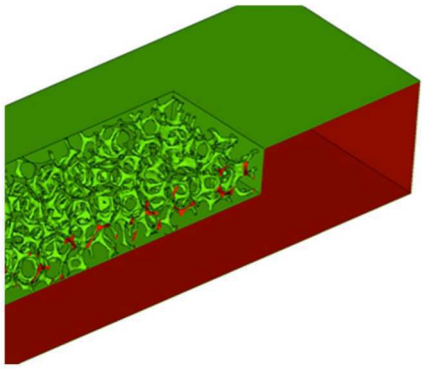
THE TECHNOLOGY

In order to improve the properties of monolithic metallic materials, alloying additions are made that create secondary phases and/or precipitate structures. These improvements must occur during melt solidification and are governed by the thermodynamics of the process. That is, optimizing the metallic alloy is possible only as much as thermodynamics allow.

Developing novel methods to combine metallic compositions/alloys into a fully dense material is of interest to create materials with novel property combinations not available with monolithic alloys.While various approaches for layering two-dimensional materials exist, their capabilities are typically limited and non-isotropic. Further, while three-dimensional composites may be formed with conventional powder metallurgy processes, it is generally very difficult to control the arrangement of the phases, for example due to randomness created by mixing powders.

This invention is method for creating a multiple alloy composite structures by forming a three-dimensional arrangement of a first alloy composition, in which the three-dimensional arrangement has a substantially open and continuous porosity. The three-dimensional arrangement of the first alloy composition is infused with at least a second alloy composition. The three-dimensional arrangement is then consolidated into a fully dense solid structure.





Proof of Concept from commercially-available aluminum foam

PUBLICATIONS

Patent Pending

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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