Non-Confidential Description - PSU No. PSSHE-18

“Method for Creating Porous Metal Structures by Particle Expansion”

Keywords:
Metal foams, solid-state foaming, alloy foams, energy absorbing, high surface area, filtration

Links:
• http://www.materialviews.com/aero-a-new-method-for-creating-metal-foams/
• http://www.engineering.com/DesignerEdge/DesignerEdgeArticles/ArticleID/7431/Metal-Foam-Gets-a-Makeover.aspx
• http://blogs.millersville.edu/atwater/research.nanostructured-metals/solid-state-foaming/

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Background
Processes for creating metal foams can be complex and time consuming, often employing gas injection, decomposition of a blowing agent, or foaming of pre-cursor scaffolding. Current methods, such as gas entrainment, have limits to achievable porosity due to pore coalescence and percolation.

Invention Description
This new technology can easily create metal foams with porosity greater than 65%, using basic powder metallurgy concepts and no specialized equipment. The process is unique in that expansion occurs within the particles, not between them. Very small pores, less than a few microns in diameter, of controlled-size can be fabricated, and overall porosity can be controlled. It is anticipated that this technology may be applied to a variety of metals and alloys, possibly including titanium. Though not necessary, cryogenic processing can create extensive nano- to micron-sized porosity in relatively short times (a few hours for alloying and expansion). The creation of small bulk parts has been demonstrated, with no fundamental limits on scale. The material can be used for advanced filters, catalyst supports, energy-absorbing components, thermal and sound insulation, and heat transfer components.

Advantages/Applications
• Porous, three-dimensional metal foams
• Micron pores and grains
• Open or closed cell porosity
• Graded porosity possible
• Inexpensive, rapid fabrication
• Temperature and Foaming Decoupled
• Porosity greater than 65%
• Foaming of various metals and alloys

*Note: This invention was created at and is owned by Millersville University, but is managed by Penn State under agreement.

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