J Ind Electron Appl 2021, S10

Journal of electrical engineering and electronics technology

Short Communication

A SCITECHNOL JOURNAL

Manufacturing and enhanced performance of metallic lattice structures by additive manufacturing

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Abstract:

Lattice structures (Periodic cellular materials) are a type of architectures constructed by an array of spatial periodic unit cells with edges and faces. Although lattice structures exhibit a range of superior properties, such as low elastic modulus, high specific stiffness and strength, large surface area, a large number of internal pores, and relatively low-stress level, the manufacturing by traditional technologies and the optimization of properties of lattice structured are limited because of poor control over the morphological characteristics of the pore network. The recent advances in metal additive manufacturing (AM) technologies have enlarged the design and manufacturing possibilities for lattice structures, which provides lattice structures with promising solutions for a variety of applications. This work presents the recent progress of additive manufacturing and enhanced mechanical and catalytic performance of lattice structures. The selective laser melting (SLM) produced and electron beam melting (EBM)-produced beta-type biomedical titanium lattice structures, as potential load-bearing implants, demonstrate excellent mechanical properties in terms of high super-elasticity, low Young's modulus and high compression strength, high energy absorption and fatigue properties. In addition, SLM-produced porous Fe-based metallic glass composite has a superior overall catalytic ability with high reaction rate constant and low activation energy than other catalysts. The reported reusability and overall catalytic ability in SLM-produced porous Fe-based metallic glass matrix composite hold the promise to design new generation catalyst approaching practical application and high economic value.

Biography

Lai-Chang Zhang is a Professor of Materials Engineering and the Program Leader–Mechanical Engineering in the School of Engineering at Edith Cowan University (Perth, Australia). After awarded his PhD in Materials Science and Engineering at the Institute of Metal Research, Chinese Academy of Sciences, Prof. Zhang held several positions at The University of Western Australian, University of Wollongong, IFW Dresden and Technical University of Darmstadt. His research interests include metal additive manufacturing, light-weight alloys, nanocrystalline materials and metallic glasses, and nanomaterials for water treatment. He has published about 280 referred journal papers with an H-index of 60 and 10000+ citations and 22 ESI Highly Cited Papers. He also served as Editors or Editorial Board Members for several journals, e.g. Advanced Engineering Materials, Metals, Frontiers in Materials, Materials Science and Technology, etc.

Publication of speakers

1. Liu YJ, Li SJ, Wang HL, Hou WT, Hao YL, Yang R, Sercombe TB, Zhang LC* (2016) Microstructure, defects and mechanical behavior of beta-type titanium porous structures manufactured by electron beam melting and selective laser melting. Acta Materialia 113:56-67.
2. Liu YJ, Wang HL, Li SJ, Wang SG, Wang WJ, Hou WT, Hao YL, Yang R, Zhang LC* (2017) Compressive and fatigue behavior of beta-type titanium porous structures fabricated by electron beam melting. Acta Materialia 126: 58-66.
3. Liu YJ, Li SJ, Zhang LC*, Hao YL, Sercombe TB (2018) Early plastic deformation behaviour and energy absorption in porous β-type biomedical titanium produced by selective laser melting. Scripta Materialia 153:99-103.

Citation: Zhang.L, Manufacturing and enhanced performance of metallic lattice structures by additive manufacturing, May 20-21, 2021, Osaka, Japan