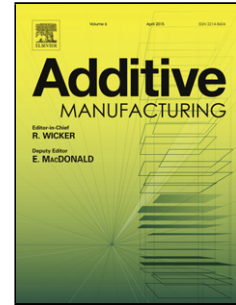


Accepted Manuscript

Title: High-stiffness and strength porous maraging steel via topology optimization and selective laser melting

Author: Akihiro Takezawa Yuichiro Koizumi Makoto Kobashi

PII: S2214-8604(16)30332-3
DOI: <https://doi.org/doi:10.1016/j.addma.2017.10.004>
Reference: ADDMA 225



To appear in:

Received date: 30-11-2016
Revised date: 19-9-2017
Accepted date: 1-10-2017

Please cite this article as: Akihiro Takezawa, Yuichiro Koizumi, Makoto Kobashi, High-stiffness and strength porous maraging steel via topology optimization and selective laser melting, *Additive Manufacturing* (2017), <https://doi.org/10.1016/j.addma.2017.10.004>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

High-stiffness and strength porous maraging steel via topology optimization and selective laser melting

Akihiro Takezawa^{a,*}, Yuichiro Koizumi^b, Makoto Kobashi^c

^a*Department of Transportation and Environmental Systems, Graduate school of Engineering, Hiroshima University, 1-4-1 Kagamiyama, Higashi-Hiroshima, Hiroshima 739-8527, Japan*

^b*Institute for Materials Research, Tohoku University, 2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan*

^c*Department of Materials Process Engineering, Graduate School of Engineering, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan*

Abstract

Recent additive manufacturing technologies can be used to fabricate porous metals with precise internal pore structures and effective performance. We use topology optimization to derive an optimal pore structure shape with high stiffness that is verified experimentally. The design maximizes the effective bulk modulus and isotropic stiffness, and the performance is compared with Hashin-Shtrikman (HS) bounds. The optimized structure is fabricated via selective laser melting of maraging steel, which is a high-strength, iron-nickel steel that cannot easily be made porous with conventional methods. The optimal porous structure achieved 85% of the performance of the HS upper bound in numerical simulations, and at least 90% of them were realized in compressive testing. Finally, the performance is discussed relative to that of

*Corresponding author. Tel: +81-82-424-7544; Fax: +81-82-422-7194

Email addresses: akihiro@hiroshima-u.ac.jp (Akihiro Takezawa), koizumi@imr.tohoku.ac.jp (Yuichiro Koizumi), kobashi@numse.nagoya-u.ac.jp (Makoto Kobashi)

Download English Version:

<https://daneshyari.com/en/article/5020011>

Download Persian Version:

<https://daneshyari.com/article/5020011>

[Daneshyari.com](https://daneshyari.com)