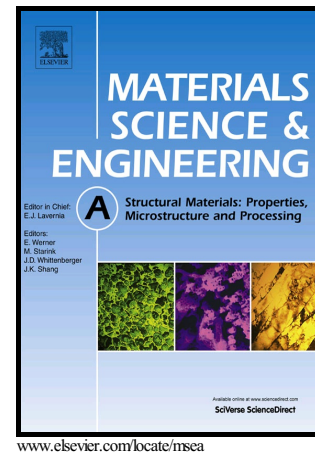


Author's Accepted Manuscript

Microstructure characterization and mechanical behavior of laser additive manufactured ultrahigh-strength AerMet100 steel

Xianzhe Ran, Dong Liu, An Li, Huaming Wang, Haibo Tang, Xu Cheng



PII: S0921-5093(16)30254-4
DOI: <http://dx.doi.org/10.1016/j.msea.2016.03.051>
Reference: MSA33446

To appear in: *Materials Science & Engineering A*

Received date: 23 December 2015
Revised date: 7 March 2016
Accepted date: 8 March 2016

Cite this article as: Xianzhe Ran, Dong Liu, An Li, Huaming Wang, Haibo Tang and Xu Cheng, Microstructure characterization and mechanical behavior of laser additive manufactured ultrahigh-strength AerMet100 steel, *Materials Science & Engineering A*, <http://dx.doi.org/10.1016/j.msea.2016.03.051>

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 galley proof before it is published in its final citable 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.

Microstructure characterization and mechanical behavior of laser additive manufactured ultrahigh-strength AerMet100 steel

Xianzhe Ran^{a,c}, Dong Liu^{a,b,c}, An Li^{a,b,c*}, Huaming Wang^{a,b,c}, Haibo Tang^{a,b,c}, Xu Cheng^c

^aNational Engineering Laboratory of Additive Manufacturing for Large Metallic Components, 37 Xueyuan Road, Beijing 100191, China

^bEngineering Research Center of Ministry of Education on Laser Direct Manufacturing for Large Metallic Component, 37 Xueyuan Road, Beijing 100191, China

^cSchool of Materials Science and Engineering, Beihang University, 37 Xueyuan Road, Beijing 100191, China

*Corresponding author. Tel.: +86 10 8233 9691; Fax: +86 10 8233 8131; Email address: li_an@buaa.edu.cn

Abstract

Ultrahigh-strength AerMet100 steel thick plate was fabricated by laser additive manufacturing process. The as-deposited microstructures of the test steel were characterized using optical microscopy (OM), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and X-ray diffraction (XRD). The mechanical properties were then examined using vickers-hardness test and tensile test. Results indicate that the as-deposited microstructures of the steel mainly consist of grain boundary allotriomorphic ferrite (GBA), grain interior irregular proeutectoid ferrite, plate-like upper bainite, needle-like lower bainite and retained austenite, which result in a good strength and some ductility anisotropy. The low deformation compatibility of specimen at the transverse direction (perpendicular to the deposition direction) mainly ascribes to the poor cracking resistance of the prior-austenite columnar grain boundary with coarse GBA phases. Compared to the almost intergranular cracking taken place in the transverse tensile specimen, the fracture mode of the longitudinal tensile specimen is a mixed mode of the predominant transgranular cracking and minor intergranular cracking.

Keywords: Laser melting deposition; Laser additive manufacturing; AerMet100 steel; Microstructure; Mechanical behavior

1 Introduction

Ultrahigh-strength steel (UHSS) is a class of structural steel with the yield strength above 1350MPa[1]. AerMet100 steel, 23Co14Ni11Cr3Mo, is a high Ni-Co series secondary hardening UHSS. Generally, it is normally used at a slightly overaged condition (tempered at 482°C for 5 hours) with the microstructures of unrecovered highly dislocated Fe-Ni martensitic laths/packets, extremely fine homogeneously dispersed M₂C (M=Cr, Mo, Fe) alloy carbides and thin film-like

Download English Version:

<https://daneshyari.com/en/article/7975470>

Download Persian Version:

<https://daneshyari.com/article/7975470>

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