

Accepted Manuscript

Title: Wire and Arc Additive Manufactured Steel: Tensile and Wear Properties

Authors: C.V. Haden, G.S. Zeng, F.M. Carter III, C. Ruhl, B.A. Krick, D.G. Harlow



PII: S2214-8604(16)30145-2
DOI: <http://dx.doi.org/doi:10.1016/j.addma.2017.05.010>
Reference: ADDMA 178

To appear in:

Received date: 20-6-2016
Revised date: 18-4-2017
Accepted date: 21-5-2017

Please cite this article as: C.V.Haden, G.S.Zeng, F.M.Carter, C.Ruhl, B.A.Krick, D.G.Harlow, Wire and Arc Additive Manufactured Steel: Tensile and Wear Properties (2010), <http://dx.doi.org/10.1016/j.addma.2017.05.010>

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.

Wire and Arc Additive Manufactured Steel: Tensile and Wear Properties

C. V. Haden^{a,*}, G. S. Zeng^a, F. M. Carter III.^{a,1}, C. Ruhl^a, B. A. Krick^a, D. G. Harlow^a

^a Department of Mechanical Engineering and Mechanics, Lehigh University, Bethlehem, PA 18015 USA

¹ Present address: Sciaky Global Headquarters, Sciaky, Inc. 4915 W 67th St. Chicago, IL 60638 USA

* Corresponding author: christina.haden@lehigh.edu

Abstract: The present study systematically investigated the mechanical properties of wire-based (wire and arc additive manufacturing, known as WAAM) deposition of steel metals, both stainless steel 304 and mild steel ER70S. Graded material properties of stainless steel 304 were observed for wear and hardness in the direction of deposition and in Z height, due to variations in local thermal histories of the metal. Wear rates decreased significantly ($p = 5.6 \times 10^{-12}$ by one-way ANOVA) along the length of the deposited material, from $\mu = 2.62 \times 10^{-5} \text{ mm}^3 / \text{N} \cdot \text{m}$ and $\sigma = 2.32 \times 10^{-6} \text{ mm}^3 / \text{N} \cdot \text{m}$, to $\mu = 0.63 \text{ mm}^3 / \text{N} \cdot \text{m}$ and $\sigma = 3.08 \times 10^{-6} \text{ mm}^3 / \text{N} \cdot \text{m}$, whereas microhardness values increased significantly ($p \sim 0$ by one-way ANOVA) along the same path from $\mu = 202.3 \text{ HV}$ and $\sigma = 5.82 \text{ HV}$ to 210.9 HV and $\sigma = 5.91 \text{ HV}$. The yield and ultimate strength, however, were not found to be statistically significantly different ($p = 0.55$) along the direction of deposition for SS304. During wear testing, a grain refinement was observed directly beneath the wear scar in these materials in a focused ion beam channel observed under scanning electron microscopy. Additionally, no significant difference in yield strength was observed in printed mild steel (ER70S) between vertical and horizontal specimens. The observed graded

Download English Version:

<https://daneshyari.com/en/article/5020129>

Download Persian Version:

<https://daneshyari.com/article/5020129>

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