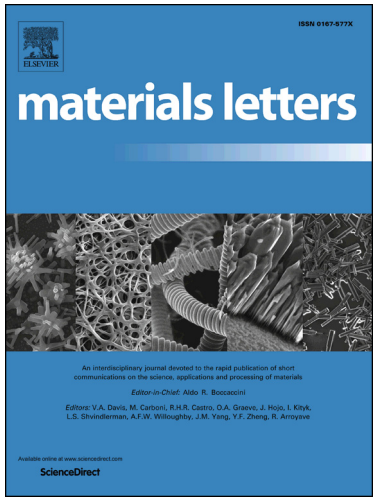

The graded microstructures evolving with thermal cycles in pure copper processed by laser metal deposition

H.Z. Zhong, C.G. Li, X.Y. Zhang, J.F. Gu

PII: S0167-577X(18)31146-7
DOI: https://doi.org/10.1016/j.matlet.2018.07.105
Reference: MLBLUE 24671

To appear in: *Materials Letters*

Received Date: 13 February 2018
Revised Date: 9 July 2018
Accepted Date: 24 July 2018

Please cite this article as: H.Z. Zhong, C.G. Li, X.Y. Zhang, J.F. Gu, The graded microstructures evolving with thermal cycles in pure copper processed by laser metal deposition, *Materials Letters* (2018), doi: https://doi.org/10.1016/j.matlet.2018.07.105

The graded microstructures evolving with thermal cycles in pure copper processed by laser metal deposition

H. Z. Zhong [a, b], C. G. Li [c], X.Y. Zhang [b], J. F. Gu [a,b] *

[a] Institute of Materials Modification and Modelling, Shanghai Jiao Tong University, Shanghai 200240, China

[b] Shanghai Key Laboratory of Materials Laser processing and Modification, Shanghai Jiao Tong University, Shanghai 200240, China

[c] Shanghai Key Laboratory of Advanced High-temperature Materials and Precision Forming, School of Materials Science and Engineering, Shanghai Jiao Tong University, Shanghai 200240, China

Abstract A single-trace copper wall is deposited by laser metal deposition and oxygen is introduced via removing the vacuum protection equipment. The corresponding microstructures at different positions are characterized by optical microscopy, scanning electron microscopy and transmission electron microscopy. Graded microstructures with the equiaxed grains of copper, macro-precipitates of Cu_2O in top position and equiaxed grains, macro-precipitates and nano-precipitates of Cu_2O in bottom position are obviously observed. The macro-precipitates are formed in the primary thermal cycle while the nano-precipitates are formed in the latter thermal cycles and contribute to larger hardness. This work reveals the microstructure evolution of Cu_2O precipitate and indicate the specific mechanical priority of copper production by additive manufacturing.

Key words: Laser processing, Thermal cycles, Nano-size, Particles.

*Corresponding author. gujf@sjtu.edu.cn

1. Introduction

A new processing of additive manufacturing (AM), including the laser metal deposition (LMD), selective laser melting (SLM) and selective electron beam melting (SEBM), is characterized for its material saving, precise formation and decreased defect properties. The specimen or component processed by AM is built track by track to form a layer, then layer by layer to form a complicated structure. The