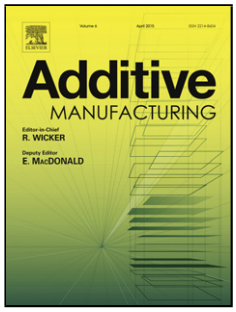
Accepted Manuscript



Title: Simulation of the multi-component process gas flow for the explanation of oxidation during laser cladding

Authors: Florian Wirth, Konrad Wegener

PII: S2214-8604(18)30658-4
DOI: https://doi.org/10.1016/j.addma.2018.10.010
Reference: ADDMA 533

To appear in:

Received date: 30-8-2018
Revised date: 3-10-2018
Accepted date: 3-10-2018

Please cite this article as: Wirth F, Wegener K, Simulation of the multi-component process gas flow for the explanation of oxidation during laser cladding, *Additive Manufacturing* (2018), https://doi.org/10.1016/j.addma.2018.10.010

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.

ACCEPTED MANUSCRIPT

Simulation of the multi-component process gas flow for the explanation of oxidation during laser cladding

Florian Wirth[*], Konrad Wegener[#]

[*]*inspire AG, ETH Zürich, Technoparkstr. 1, 8005 Zurich, Switzerland*

[#]*Institute of Machine Tools and Manufacturing, ETH Zürich, Leonhardstr. 21, 8092 Zurich, Switzerland*

Corresponding Author:

Florian Wirth ,e-mail: wirth@inspire.ethz.ch

tel.: +41 44 633 78 74 ,fax: +41 44 632 11 59

Abstract

Usually the process gas flow rates and the process gas types are not regarded as the primary process parameters of the laser cladding process. Herein it is shown, how the melt pool surface oxidation can be significantly reduced by the change of the carrier gas type, by a reduced carrier gas flow rate and by minor changes in the powder nozzle design. However, the absorptivity may decrease concurrently by up to 15%. A simulation model for the gas flow and the powder particle flow between the powder nozzle and the melt pool surface has been developed, which reveals the volume percentage of different gas types and so the quality of the shield gas atmosphere. Additionally, the powder particle distribution and the attenuation of the laser beam by the powder particles can be simulated. The simulation results are confirmed by experimental measurements of the powder particle density distribution in the working plane, by measurements of the oxygen volume percentage at the workpiece surface, by high-speed camera images of the melt pool surface and by absorptivity measurements, which show the effect of oxidation on the process.

Keywords: Laser cladding; Direct Metal Deposition; powder nozzle; process gas flow; oxidation

1. Introduction and state of research

The powder nozzle and the laser beam are the essential tools of the laser cladding process as shown in Fig. 1. While the laser beam keeps the melt pool in liquid

Download English Version:

https://daneshyari.com/en/article/11027750

Download Persian Version:

https://daneshyari.com/article/11027750

Daneshyari.com