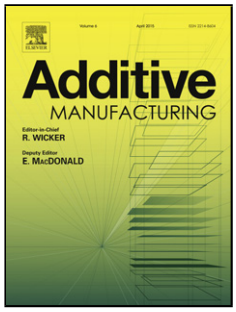

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PII: S2214-8604(18)30054-X
DOI: https://doi.org/10.1016/j.addma.2018.03.020
Reference: ADDMA 316

To appear in:

Received date: 29-1-2018
Revised date: 16-3-2018
Accepted date: 18-3-2018

Please cite this article as: Lopez A, Bacelar R, Pires I, Santos TG, Sousa JP, Quintino L, Non-destructive testing application of radiography and ultrasound for wire and arc additive manufacturing, *Addit Manuf* (2010), https://doi.org/10.1016/j.addma.2018.03.020

NON-DESTRUCTIVE TESTING APPLICATION OF RADIOGRAPHY AND ULTRASOUND FOR WIRE AND ARC ADDITIVE MANUFACTURING

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Abstract

The present work addressed the challenges of identifying applicable Non-Destructive Testing (NDT) techniques suitable for inspection and materials characterization techniques for Wire and Arc Additive Manufacturing (WAAM) parts. With the view of transferring WAAM to the industry and qualifying the manufacturing process for applications such as structural components, the quality of the produced parts needs to be assured. Thus, the main objective of this paper is to review the main NDT techniques and assess the capability of detecting WAAM defects, for inspection either in a monitoring, in-process or post-process scenario. Radiography and ultrasonic testing were experimentally tested on reference specimens in order to compare the techniques capabilities. Metallographic, hardness and electrical conductivity analysis were also applied to the same specimens for material characterization. Experimental outcomes prove that typical WAAM defects can be detected by the referred techniques. The electrical conductivity measurement may complement or substitute some destructive methods used in AM processing.

Keywords – Arc-Based Additive Manufacturing, Non-Destructive Testing, Materials Characterization, Ultrasonic testing, Eddy currents.

1. Introduction

Additive Manufacturing (AM) is increasingly gaining a relevant place in the manufacturing industry, in a very large range of available materials. However, the potential of AM processes to produce large parts is still requiring significant research to reach a reliable industrial implementation.

Wire and Arc Additive Manufacturing (WAAM) recently proved to have the potential for the production of large scale engineering structures . This manufacturing technique combines an electric arc as heat source and wire as feedstock to produce components, adopting the same technologies and equipment as in welding. These arc-based AM technologies are receiving considerable attention from the manufacturing industry due to the capability of producing customized large parts, with a high deposition rate, at lower cost, in comparison with other additive