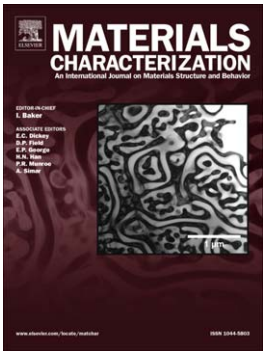

Grating-based X-ray dark-field computed tomography for the characterization of friction stir welds: a feasibility study

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PII: S1044-5803(17)30104-3
DOI: doi: 10.1016/j.matchar.2017.04.023
Reference: MTL 8646

To appear in: *Materials Characterization*

Received date: 17 January 2017
Revised date: 19 April 2017
Accepted date: 24 April 2017

Please cite this article as: Schaff Florian, Bachmann Andreas, Zens Amanda, Zaeh Michael F., Pfeiffer Franz, Herzen Julia, Grating-based X-ray dark-field computed tomography for the characterization of friction stir welds: a feasibility study, *Materials Characterization* (2017), doi: 10.1016/j.matchar.2017.04.023

Grating-based X-ray dark-field computed tomography for the characterization of friction stir welds: a feasibility study

Abstract

Friction Stir Welding (FSW) is a relatively new joining technology. It is mostly applied to weld aluminium alloys, which are difficult to fusion weld. Characterization of these welds has thus far been done almost exclusively by optical or electron microscopy, which only provide surface information about the material. The third dimension is only accessible with other methods, the most common being X-ray computed tomography. In order to image microstructural changes introduced by the welding process, conventional X-ray analysis needs to be performed with very high spatial resolution, which limits the investigations to small volumes. In this paper we present how the recently developed method of grating-based X-ray dark-field imaging is able to retrieve information of the micro-structure in macroscopic friction stir welds. We compare results obtained with optical microscopy and dark-field imaging and show how equivalent geometrical measures can be retrieved from both methods. As dark-field imaging is based on X-rays we extend the analysis to the third dimension. These first results demonstrate the use of grating-based X-ray dark-field imaging as a supplement to the established characterization methods for FSW welds.

Keywords: `friction stir welding`, `X-ray dark-field imaging`, `computed tomography`

1. Introduction

Friction Stir Welding. Increasing fuel costs and the need for environmental protection are challenges that are being faced by the automotive and aerospace