Lasers in Manufacturing Conference 2021

Structure-borne acoustic process monitoring of laser metal deposition

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Abstract

Acoustic emissions have been used as a means for process monitoring and non-destructive testing in welding to determine process characteristics, detect anomalies and infer the quality of the welded part. While air-borne noise has been studied extensively, research on the application of body-borne sound in the process monitoring of laser metal deposition remains limited. This paper examines the use of structure-borne sound for in-process monitoring of the deposition of the nickel-based superalloy CMSX-4. Due to the low weldability of the material and its susceptibility to hot-cracking, there arises a need for an in-process, non-destructive method for monitoring cracking. A high-frequency-impulse-measuring device (QASS GmbH) up to 50 MHz was attached to the substrate mount. The frequency data of the signal over time was evaluated by analysing the short-time Fourier transform (STFT) of the raw acoustic data, the acoustic characteristics of the process were determined, acceptable thresholds set and cracking detected.

Keywords: Laser welding; process monitoring

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