

Achieving cost-effective laser manufacturing through cutting-edge inspection

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The cost-effective manufacture and validation of miniature components for the aerospace and automotive sectors has taken a significant step forward thanks to a recently-completed EU project. A series of systems for the rapid in-line inspection of laser powder deposited layers has been developed and trialled, using cutting edge non-destructive testing techniques.

Improvements in [laser](#) metal deposition (LMD) [technology](#) over the past 20 years have led to its increased applicability in a number of fields. These include the manufacture, repair and coating of small intricate parts that can be used in aero and automobile engines.

The process uses a laser beam to form a melt pool on a metallic substrate, into which powder is fed. The powder melts to form a deposit that is fusion bonded to the substrate. The required geometry is built up layer by layer.

The layers are either 300 microns or 20-50 microns thick depending on the process used. Both the laser and nozzle from which the powder is delivered tend to be manipulated using a robotic arm.

The technology has significant potential advantages over conventional casting methods, precisely because it enables small parts with internal features to be built. Up until now however, the application of this technology has been somewhat limited due to the need for constant oversight, because the absence of flaws cannot be guaranteed.

This is why the two-year EU-funded project, entitled INTRAPID (Innovative inspection techniques for laser powder deposition quality control), sought to improve the inspection process. The ultimate aim has been to make the technology much more cost-effective by identifying inspection processes capable of handling complex operations.

The project focused on three non-destructive testing (NDT) techniques - laser ultrasonics (using lasers to generate and detect ultrasonic waves), Eddy currents (electric currents induced by a changing magnetic field) and laser thermography (detecting radiation in the infrared range of the electromagnetic spectrum). These system designs were selected because each has a small inspection footprint, vital in order to inspect a thin deposited layer.

Final demonstrations of the new methods took place in August 2013, showing all three techniques in operation, attached in turn to the same robot carrying out the deposition. To determine inspection performance, the researchers produced a wide range of reference samples in different

materials and of varied shape containing machined flaws, which were spotted by the inspection systems.

The project team was able to successfully demonstrate that inspection can follow the deposition process by means of a simple translation of robot movement. Specialist equipment together with a new software suite was also developed as part of the project.

The INTRAPID project was a collaboration of European SMEs and research organisations. Completed in August 2013, the [project](#) received €1 122 700 in EU funding.

More information: www.intrapid.eu

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