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IBR manufacturing by hybrid combination of Laser Metal Deposition and machining processes

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Abstract (300 word limit)

The use of additive manufacturing (AM) technologies in aeronautic industries is on increase. An example of this is the fact that most companies in the sector have started to combine additive with machining operations. The Laser Metal Deposition (LMD) process is one of the most used AM methods together with the Selective Laser Melting (SLM) process, but only the first one is currently capable of producing big parts.

The LMD technology can work with a wide range of metals; some of them are common within the aeronautic industry, such as Titanium, Inconel 718 and Hastelloy X, among others.

This technology implies big challenges due to its complexity; in order to attain good results a high number of process parameters must be controlled, like laser power, gas and powder flux, filling strategies, feed rate, to name just a few.

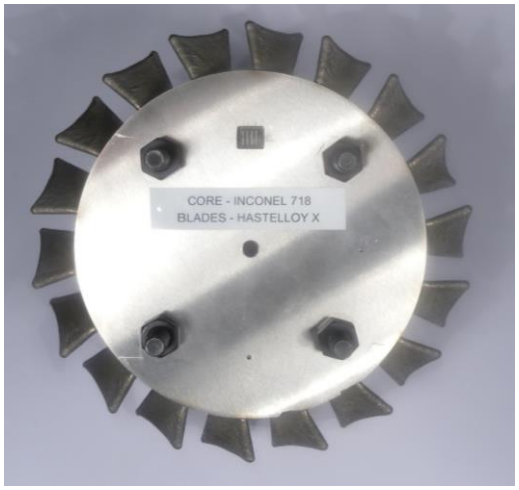


Figure 1. Hastelloy X manufactured blades.

The present research work aims to study the manufacturing and repair of turbine components, such as blisk, by LMD. To that end, a blisk is manufactured by additively building up blades on a core disk substrate. In addition, a monitoring of the temperature of the process and the height of the clad is also realized. Therefore, this work demonstrates the feasibility of manufacturing and repairing high added value parts by 5-axis LMD.

Key words: laser metal deposition; additive manufacturing; BLISK; Hastelloy X; monitoring

Recent Publications (minimum 5)

1. Arrizubieta J I, Martinez S, Lamikiz A, Ukar E, Arntz K, Klocke F (2017) Instantaneous powder flux regulation system for Laser Metal Deposition, Journal of Manufacturing Processes xxx pp. xxx-xxx. ISSN:1526-6125;

   http://dx.doi.org/10.1016/j.jmapro.2017.07.018

2. Arrizubieta J I, Lamikiz A, Klocke F, Martinez S, Arntz K, Ukar E (2017) Evaluation of the relevance of melt pool dynamics in Laser Material Deposition process modeling, International Journal of Heat and Mass Transfer Vol 115. pp. 80-91. ISSN: 0017-9310; http://dx.doi.org/10.1016/j.ijheatmasstransfer.2017.07.011;

3. Calleja A, Tabernero I, Ealo J A, Campa, F J, Lamikiz A, López de Lacalle L N (2014) Feed rate calculation algorithm for the homogeneous material 5 deposition of blisk blades by 5-axis laser cladding, Int. J. Adv. Manufacturing Technology, DOI 10.1007/s00170-014-6057-3, ISSN: 0268-3768

4. Calleja A, Tabernero I, FernándezV A, Celaya A, Lamikiz A, López de Lacalle L N (2014) Improvement of Strategies and Parameters for Multi-Axis Laser Cladding Operations, Optics and Lasers in Engineering, Vol. 56, pages 113-120 (2014). ISSN: 0143-8166

5. Artetxe E, González H, Calleja A, Polvorosa R, Lamikiz A, López de Lacalle L N (2016) Optimised methodology for aircraft engine IBRs five-axis machining. Int. J. Mechatronics and Manufacturing Systems Vol.9, Nº4.

Biography

Aitzol Lamikiz: Professor of the Department of Mechanical Engineering at the University of the Basque Country. He is leading the laser material processing research line and is the author of 68 impact International Journal Publications, including laser material deposition process modeling, laser polishing and laser hardening research. He is the co-author of 3 books and more than 100 contributions in international conferences. Nowadays is member of the executive board in one of the three campus of the University of the Basque Country UPV/EHU.

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