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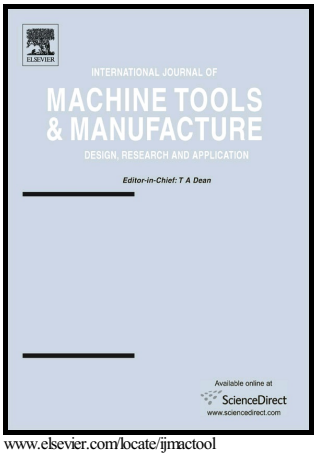


www.elsevier.com/locate/ijmactool

PII: S0890-6955(16)30465-5
DOI: http://dx.doi.org/10.1016/j.ijmachtools.2017.04.008
Reference: MTM3252

To appear in: *International Journal of Machine Tools and Manufacture*

Received date: 31 October 2016
Revised date: 8 February 2017
Accepted date: 17 April 2017

Cite this article as: Weilong Cong and Fuda Ning, A fundamental investigation on ultrasonic vibration-assisted laser engineered net shaping of stainless steel *International Journal of Machine Tools and Manufacture* http://dx.doi.org/10.1016/j.ijmachtools.2017.04.008

# A fundamental investigation on ultrasonic vibration-assisted laser engineered net shaping of stainless steel

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## Abstract

Laser engineered net shaping (LENS), a laser beam deposition additive manufacturing method, has been utilized as a key technology in the direct manufacturing or repairing of metal parts. However, deposition defects such as pores, cavity, micro-cracks, residual stress, and uncertain microstructures always exist in the LENS fabricated parts, which will greatly affect the qualities and mechanical properties. In this paper, a novel ultrasonic vibration-assisted (UV-A) LENS process is proposed to reduce or eliminate the common defects due to the nonlinear actions and influences of ultrasonic vibration in molten materials. An experimental investigation is conducted on the effects of ultrasonic vibration on fabricated part geometry, powder utilization efficiency, surface roughness, geometry of molten pool and dilution zone, pores and micro-cracks, and grain size of the LENS-deposited AISI 630 stainless steel. The mechanical properties including tensile properties and hardness of the fabricated parts are evaluated and compared