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PII: S0924-0136(18)30135-3
DOI: https://doi.org/10.1016/j.jmatprotec.2018.03.030
Reference: PROTEC 15700

To appear in: *Journal of Materials Processing Technology*

Received date: 25-12-2017
Revised date: 2-3-2018
Accepted date: 31-3-2018

Please cite this article as: Maina MR, Okamoto Y, Okada A, Närhi M, Kangastupa J, Vihinen J, High surface quality welding of aluminum using adjustable ring-mode fiber laser, *Journal of Materials Processing Tech.* (2010), https://doi.org/10.1016/j.jmatprotec.2018.03.030

High surface quality welding of aluminum using adjustable ring-mode fiber laser

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Abstract

A method to improve penetration and stabilize the welding phenomenon at a high welding speed has been described through experimental and numerical investigations. Using a high power laser beam consisting of a center and a ring part, influences of shielding gas direction and flow rate, laser power density, and welding mode defined by variable intensity distribution have been clarified. The weld bead was evaluated in terms of width, height, shape and roughness. Dual-mode laser irradiation of center and ring power made it possible to stabilize the welding process. The center power helps to achieve sufficient deep penetration, while ring power ensures good temperature distribution. Good surface quality and deep penetration welding could be achieved with dual-mode welding, using low flow rate of shielding gas supplied from the backside direction.

Keywords: Adjustable ring-mode fiber laser; Aluminum; Laser welding; Shielding gas; Surface quality.