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Modeling on Laser Welded Similar Joints Using Nickel-Based Incoloy800

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Abstract

A Nickel-based super alloy Incoloy 800 is suitable for aerospace engines and nuclear reactor applications due to its high strength and corrosion resistance properties. Many researchers have done an optimization of process parameters with a single objective response like hardness or metal removal rate etc., In this paper, Ytterbium Fiber Laser Welding (FLW) process parameters namely laser power, duty cycle, welding speed, and frequency were optimized to obtain optimum weld bead geometry, full depth of penetration, hardness, and tensile strength by Central Composite design of Response Surface Methodology to join Incoloy 800 plates of 2mm thickness. The second order empirical relationships were developed to predict the weld bead characteristics like bead width, depth of penetration, weld zone area, hardness, and tensile strength. The developed empirical relationships were used to predict the weld bead characteristics with acceptable accuracy. This paper discusses the direct and indirect interaction effect of FLW parameters on weld bead geometry, hardness & tensile strength. The microstructure of the weld bead is studied using an Optical Microscope (OM) and scanning electron microscope (SEM).

Keywords

Incoloy 800, weld bead geometry, weld zone area, ultimate tensile strength, hardness, Central composite design.

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