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Analysis of Deposition Efficiency and Distortion During Multitrack Overlay by Plasma Transferred Arc Welding of Co–Cr Alloy on 316L Stainless Steel

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Abstract

In present investigations, Co–Cr alloy powder is deposited on SS 316L substrate material by plasma transferred arc welding (PTAW) technique. Analysis is carried out by evaluating the different processing conditions as per the design of experiments by response surface methodology. Efforts are made to investigate PTAW overlay process on two compound parametric approaches governing deposition characteristics. First approach focuses on the actual mass of powder deposited by melting over a substrate surface which governs deposition efficiency and second approach reflects the heat energy supplied to the arc region causing melting of both supplied powder and substrate material resulting distortion. The deposition efficiency and distortion of substrate material are measured for each experimental condition and the effect of transferred arc current, travel speed, powder feed rate, oscillation speed and stand-off distance are investigated. For deposition efficiency, the powder feed rate is the most important process parameter and powder feed rate between 8 g/min and 12 g/min contributes excellent deposition efficiency. For deformation, the transferred arc current is the most sensitive process parameter and low current conditions, 100–120 A showed less distortion in the specimen. In order to achieve good deposition efficiency and less distortion, it is recommended to carry out PTAW deposition with arc current 120 A, travel speed 120 mm/min, powder feed rate 11 g/min and stand-off distance 8 mm.

Keywords: Deposition efficiencydistortionwelding depositionPTAWCo–Cr alloySS316L