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Austenitic stainless steels affected by chromium carbides: surface recovery by laser remelting on welded component

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Austenitic stainless steels, especially AISI 304, are recognized for their high mechanical strength, toughness and corrosion resistance in various applications. However, the presence of chromium carbides is the main cause of susceptibility to corrosion in the AISI 304. Sensitized components, generally resulting from welding, require costly treatment processes to recover corrosion resistance. Since electrochemical corrosion is a process initiated on the surface, laser surface remelting (LSR) can be a fast and effective method for carbide dissolution, given the process characteristics: high energy density, and high heating and cooling rates. The positive effect of LASER technology on the corrosion behavior of alloys was verified by Chan et al. (2018) in the aged S32950 duplex stainless steel. After LASER surface remelting, the treated material had its resistance to pitting and intergranular corrosion restored, which is attributed to the dissolution of the Cr23C6 and other deleterious phases [1]. The current work has as its objective the recovery of sensitized welds through RSL for different applied energy densities, finding the best processing window. The steels as received and treated-LSR were microstructurally characterized with an thorough investigation of their precipitates by scanning electron microscopy. Intergranular corrosion susceptibility was evaluated by ASTM A262, Practice A, and degree of sensitization (ISO 12732). Additionally, cyclic potentiodynamic polarization and electrochemical impedance spectroscopy in 0.6 M NaCl solution were performed. This study verified the effectiveness of LSR as a surface engineering technology for the recovery the intergranular corrosion resistance of austenitic stainless steels compromised by carbides. [1]CHAN, W. K.; KWOK, C. T.; LO, K. H. Effect of laser surface melting and subsequent re-aging on microstructure and corrosion behavior of aged S32950 duplex stainless steel. Materials Chemistry and Physics, v. 207, p. 451–464, mar. 2018.