Effect of sensitization on pitting corrosion resistance of laser melting 304 stainless steel

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Abstract

The present paper presents an attempt to improve the corrosion resistance of sensitized 304 stainless steel by pulsed laser surface melting. Tafel extrapolation technique was used to determine the corrosion rates in 3.5% NaCl in four conditions. These conditions are as-received, sensitized, laser treatment for as received stainless steel and laser treatments after sensitization. The results obtained are expressed in terms of corrosion parameters through electrochemical behavior namely, E^{o}, I^{o}, $E_{Corr.}$, E_{P}, I_{P}, $E_{Pit.}$ And I_{Pit}. Detailed analysis found that these parameters are strongly dependent on the microstructures of the stainless steel. The results reveal when the potentials increase means the microstructure becomes thermodynamically more stable and has good corrosion resistance. The above electrochemical parameters for sensitized 304 stainless steel show that the localized corrosion rate increases which affected the phases. The laser surface melting treatment shifts the potential toward noble direction. The corrosion current densities values shift to lower values. The comparison of anodic polarization curves indicates that the corrosion rates for laser treated samples are reduced. Increasing the corrosion resistance means that the most inclusions at the surface have been dissolved in the structure due to melting. An interesting feature is the systematic shift of the pitting potential in the noble region with a laser melting. This results confirms that the laser treatment can be used successfully to improve the localized corrosion resistance.