Effect of Laser Surface Melting on Chromium Carbide of 304 Stainless Steels

Abstract- In the present study, the effects of laser surface melting (LSM) on chromium carbide of heat treated (AISI 304) austenitic stainless steels (ASS) was studied with the aim to suppress sensitization of 304SS. Austenitic stainless steels were heated (aging) up to (800) °C at constant holding time for two hours. LSM was conducted by using a (600 W) Yb-YAG laser. The microstructure was characterized by using optical microscopy (OM), scanning electron microscopy (SEM) and X-ray diffraction (XRD). Results shows, refined and homogeneous microstructure which contains austenite (γ) as basically phase and delta ferrite (δ) as the secondary phase, however, chromium carbide (Cr$_{23}$C$_6$) phase are fully dissolved. Desensitization of heat treated ASS has been successfully achieved by LSM which reduced Cr depletion at the grain boundaries.

Keywords- Stainless steel, Laser, Surface melting, Corrosion, Pitting, Sensitization, Chromium Carbide, Delta ferrite, solidification mode, Surface Engineering.