

Microstructural analysis of martensitic hard surfacing on low chromium alloy steel

Abstract

This study focuses on the metallurgical characterization of single and multi-layer martensitic hard surfacing onto non-standardized low-chromium alloy steel with a single buttering layer using an automatic submerged arc welding process as a standard reference. The metallurgical properties of hard surfaced samples are examined using an optical microscope, energy dispersive x-ray spectroscopy, and x-ray diffractometer. Micro-Vickers hardness testing is also conducted to analyze and confirm the metallographic results of hard surfacing. The current study finds that the microstructure of each region is influenced by three key factors: chemical composition, heat input, and dilution. The structural type is determined by the chemical composition of materials, heat input influences the structural characteristics in the heat-affected zone (needle-shape martensite and tempered martensite), and dilution affects the structural characteristics of the hard surfacing layers (martensite with retained austenite). Comparing multi-layer hard surfacing to single-hard surfacing, the hardness values of the heat-affected zone of the multi-layer hard surfacing are greatly reduced, while the hardness values of the hard surfacing layers are raised. © 2023 Wiley-VCH GmbH.

Keywords

dilution; hard surfacing; heat input; microstructure; submerged arc welding