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Influence of heat input on microstructure and mechanical properties of Ferritic Stainless Steel welds

Nabil Bensaid, Nacer TALA IGHIL, Riad BADJI, Mohamed HADJI, Mohamed Farid Benlamnouar

Abstract : Ferritic stainless steels are classified as such because the predominant metallurgical phase present is ferrite. These steels are characterized by good resistance to stress corrosion cracking (SCC), pitting corrosion, crevice corrosion (particularly in chloride environments), higher thermal conductivity, low coefficient of heat dilation and lower cost, when compared to austenitic stainless steels. The combination of low cost and good properties has made ferritic stainless steel more and more attractive in various application fields, such as, heat exchangers, petroleum refining equipment, storage vessels, protection tubes, solar water heaters, and exhaust manifold applications. However, ferritic stainless steel steels are associated with many problems during the welding process. These problems are the martensite formation and grain growth, causing a reduction of ductility and toughness. For these reasons, until recently, the application of this group steels is limited in welded structures. The aim of the work is, first to characterize the weld metal, as variable GTA welding process parameters and optimize the heat input. We focused on improving tensile strength of ferritic stainless steel. The results show that, the heat input has a great influence on microstructure and mechanical proprieties of weld metal. The details of tensile tests, optical microscopic observations, microhardness, and Scanning electron microscopy (SEM) fractography, are discussed.

Keywords : GTA welding, heat input, ferritic stainless steel, microstructure, mechanical properties, Fractography