Short Communication

Effects of Ti on Microstructure, Mechanical Properties and Corrosion Behavior of High-Strength Steel Weld Metals for Offshore Structures

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Micro-alloying elements significantly affect the microstructure, mechanical properties and corrosion behavior of the high-strength steel weld metals. In this paper, the effects of Ti content on the microstructure, mechanical properties and corrosion behavior of 690 MPa level high-strength steel shielded metal arc welding (SMAW) weld metal were studied. It is indicated that the grain refinement strengthening is the main strengthening mechanism for the weld metals. The microstructure, the formation of the oxide, the mechanical properties, and the corrosion resistance of the weld metal were remarkably affected by the addition of Ti. With the increase of Ti content, the grains of the weld metal were refined. Both the tensile strength and corrosion resistance were improved, while the impact property decreased. The Mn and Si oxides were covered more completely by the Ti oxides with the increase of the Ti content, forming Mn, Si, and Ti complex oxides, which resulted in the increase of the acicular ferrite. However, excessive addition (0.022 wt.%) of Ti led to the decrease of the acicular ferrite and the formation of lath bainite. The formation of lath bainite is the main reason for the deterioration of the impact property and corrosion resistance of the weld metal.

Keywords: Microstructure, Ti content, Weld metal, 690 MPa high-strength steel, Mechanical properties, Corrosion behavior

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