

# Effect of root pass filler metal on microstructure and mechanical properties in the multi-pass welding of duplex stainless steels

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**Abstract:** This paper is focused on the estimation of the effect of root pass chemical composition, in multi-pass GTA Weldments, on microstructure and mechanical properties of duplex stainless steel welds. We used two different filler metals, the super duplex ER2594 and duplex ER 2209. Microstructures of different passes of welded joints are investigated using optical microscope and scanning electron microscope. The relationship between mechanical properties, corrosion resistance, and microstructure of welded joints is evaluated. It is found that the tensile and toughness properties of the first weldment, employing the combination of ER 2594 in the root pass and ER 2209 in the remaining, are better than that of the second weldment employing ER 2209 all passes, due to the root pass grains refinement and its alloy elements content as chromium Cr and nitrogen N. The microstructure indicates the presence of austenite in different forms on the weld zone of ER 2209, same in the case of ER 2594, but with higher content and finer grains size, in particular Widmanstätten austenite WA. Potentiodynamic polarization tests of the first weld metal evaluated in 3.5% NaCl solution at room temperature have been demonstrated a corrosion resistance higher than that of the second weld metal. This work addressed the improvement of the corrosion resistance using appropriate filler metal without getting any structural heterogeneity and detrimental changes in the mechanical properties.

**Keywords :** Gas tungsten arc welding (GTAW), duplex stainless steel, Root pass, Filler metal, Microstructure and mechanical properties