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Effect of nitrogen addition to shielding gas on cooling rates and microstructure of thin plates of duplex stainless steel welded by pulsed GTAW process

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The content of nitrogen to shielding gas and their effects on temperature distributions of the heat-affected zone of thin plates of duplex stainless steel during the pulsed GTAW process has been studied here. The duplex stainless steels have many features due to unique structural combination of austenite and ferrite grains. The phase balance can be easily altered to a mostly ferritic microstructures, depending on the welding parameters like shielding gas used. Microstructural examination showed that the austenite phase in the weld increases with the presence of nitrogen in the shielding gas. The additional nitrogen promoted the primary austenite formation and slightly increased the microhardness of the solidified zone. Microhardness mapping and metallographic imaging presented information about microstructures, confirming the formation of secondary phases and microstructure sensitization during thermal cycle in the temperature range 850-950°C. Two plates were welded using pure argon and pure argon plus 2% of nitrogen as shielding gas. The thermal profile had shown that N2-supplemented shielding gas lead to high peaks of temperature using similar welding parameters. The columnar and equiaxied ferrite grain size of solidified fusion zone was studied. Ferrite phase increased from 53 % in base metal to 78% to pure Ar and 63% using Ar+2%N2 as shielding gas. Control of ferrite in the welds is essential mainly to improve corrosion resistance.