

Effect of processing parameters on intermetallic phase content and impact toughness for super duplex alloy PM HIP Sandvik SAF 2507™

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PM HIP is a widely applied manufacturing technology to produce thick walled and complex shaped duplex and super duplex stainless steel (DSS and SDSS) components for the petrochemical as well as the oil and gas industry. The PM HIP process offers the advantage of a fine grained microstructure which generates an increased resistance to HISC (Hydrogen Induced Stress Cracking) as well as higher yield strength. A limiting factor when producing thick walled components of DSS and SDSS alloys is the precipitation of brittle intermetallic phases which results in decreased corrosion resistance and impact toughness if high enough fractions are precipitated. The precipitation of intermetallic phases is a diffusion controlled process that may take place during quenching following solution annealing if the cooling rate is too slow. The thicker wall of the component, the slower is the cooling in the center of the wall which enables increased intermetallic phase precipitation. In this article it is shown that a coarser PM HIP microstructure results in lower contents of intermetallic phases after water quenching. However, despite of the lower intermetallic phase content the impact toughness is not improved and this is explained by the fracture mechanisms as shown by instrumented impact testing and fracture surface analysis.

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