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Effect of ageing time on mechanical properties and microstructural evolution of 2205 ferritic-austenitic stainless steel

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Abstract : The main of this study is to refine the 2205 duplex stainless steel microstructure using recrystallization process. The adopted way consists in carrying out and optimizing aging heat treatments accompanied by restoring heat treatment. A preliminary treatment of hardening since 1080°C, 1120°C and 1250°C was applied to increase the proportion of ferrite in the matrix. The treatments of aging were performed at the temperature of 850°C during variable duration periods: 30mn, 60mn, 90mn, 02h, 10h, and 30 hours. These treatments modified the structure of the 2205 duplex stainless steel, causing the appearance of a precipitation phenomenon. The precipitates were identified by x-rays diffraction as being the intermetallic σ phase, and also the chromium carbides $M_{23}C_6$. This precipitation occurs in the ferrite/ferrite and ferrite/austenite interfaces and propagated inside the ferritic grains. The treatments at 850°C caused a hardening and a remarkable drop of the impact strength of material. The last treatment was carried out at 1080°C during 01 hour, in order to dissolve σ phase which precipitate and to restore the σ/γ phases balance of the duplex steel. The grains refinement occurred mainly on ferrite; this being with the simultaneous germination of ferrite and austenite during the dissolution of the precipitates.

Keywords : duplex stainless steel, Recrystallization, Precipitation, sigma Phase, Restoring, Toughness impact.