**Effect of High Temperature Heat Treatment and Cooling on the Microstructure and Mechanical Properties of Fe-Cr-Mn-Ni-C Stainless Steel**

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**ABSTRACT**

In the present study, microstructure and mechanical properties of a Fe-Cr-Mn-Ni-C stainless steel subjected to high temperature heat treatment (1180°C for 20 min) followed by different cooling conditions (furnace cooling, air cooling and water quenching) were investigated using optical microscopy, scanning electron microscopy, differential scanning calorimetry, tensile and impact testing. The starting microstructure in the forged condition comprised of austenite, delta ferrite and sigma phase. The microstructure of the high temperature heat treatment (HTHT) samples showed variation in the content of the delta ferrite and sigma phase. Water quenched samples were free from sigma phase whereas furnace cooled samples showed maximum amount of sigma phase (10.8 %). The HTHT showed effect on the impact strength, tensile strength and ductility. The furnace cooled samples showed lower impact strength, tensile strength and ductility compared to the forged condition due to the presence of the sigma phase. Resolution treatment of furnace cooled samples at 1050°C for 0.5 h followed by air cooling was effective in reducing the sigma phase with corresponding improvement in the impact strength and tensile ductility.

*Keywords:* *Fe-Cr-Mn-Ni-C stainless steel, high temperature heat treatment, sigma phase, impact strength*

Thematic area: Special steels and Alloys