



COMPARATIVE ANALYSIS OF HARDNESS AND INTERGRANULAR CORROSION RESISTANCE OF NITROGEN AND CARBON MARTENSITES

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ABSTRACT

Martensitic stainless steels (MSS) were developed to meet the industry's demand for materials with corrosion and wear resistance. However, in very aggressive environments, carbon martensitic steels, such as AISI 420 MSS, have its application limited. Nitrogen martensitic steels have been obtained using the Solution Heat Treatment after Plasma Nitriding (SHTPN) technique, followed by quenching and tempering. This treatment involves plasma nitriding, followed by solution and rapid cooling, resulting in the dissolution of nitrides and the formation of a nitrogen martensitic layer. This study compared the nitrogen martensitic layer of AISI 409 steel treated by SHTPN, re-quenching (1050 °C) and tempering (250, 350, 450 and 650 °C) with the carbon martensite formed in AISI 420 steel, quenched and tempered at the same temperatures. The microstructure, hardness, resistance to intergranular corrosion and degree of sensitization were evaluated using optical microscopy, Vickers microhardness and DL-EPR tests. The results showed a nitrogen martensitic layer with a thickness of more than 750 µm on AISI 409 steel. A proportional reduction in hardness was observed with increasing tempering temperature for both materials, but AISI 420 steel showed higher surface hardness. Carbon martensite exhibited a higher degree of sensitization in samples tempered at 250, 450 and 650 °C compared to AISI 409 steel. In the tempering condition at 350 °C, both materials showed a similar degree of sensitization. The best results were observed for AISI 409 steel tempered at 250 °C.

Keywords: SHTPN; nitrogen martensite; intergranular corrosion; degree of sensitization; DL-EPR.