

## **Microstructure and properties of heat-treated 440C martensitic stainless steel**

### **Abstract**

440C martensitic stainless steels are widely used because of their good mechanical properties. The mechanical properties of 440C martensitic stainless steel were evaluated after heat treatment of these materials at various types of heat treatment processes. The initial part of this investigation focused on the microstructures of these 440C steels. Microstructure evaluations from the as-received to the as-tempered condition were described. In the as-received condition, the formations of ferrite matrix and carbide particles were observed in this steel. In contrast, the precipitation of  $M_7C_3$  carbides and martensitic structures were present in this steel due to the rapid quenching process from the high temperature condition. After precipitation heat treatment, the Cr-rich  $M_{23}C_6$  carbides were identified within the structures. Moreover, a 30 minutes heat-treated sample shows the highest value of hardness compared to the others holding time. Finally, the tempering process had been carried out to complete the whole heat treatment process in addition to construct the secondary hardening phenomenon. It is believed that this phenomenon influenced the value of hardness of the 440C steel.

**Keywords;** Carbide, Martensitic Stainless Steel, Precipitation Hardening, Secondary Hardening, Tempering