

Behavior of Hardness and Retained Austenite during Subcritical Heat Treatment of High Chromium Cast Irons with Molybdenum

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Abstract. Subcritical heat treatment that austenite in alloyed cast iron is tempered at the temperature below pearlite transformation (A_1) has been used to improve the matrix hardness without hardening. Two series of hypoeutectic 16 and 26 wt% Cr cast irons containing 0, 1 and 3 wt% Mo were used to investigate the behavior of hardness and retained austenite during subcritical heat treatment. The cast specimens with a size of 25 mm in diameter and 65 mm in length were sectioned for 7 mm in thickness by a wire-cutting machine. As-cast test piece was held in an electric furnace at subcritical temperatures for 50 K intervals from 773 K to 873 K for 21.6 ks to 64.8 ks and then cooled to the room temperature by fan air. Hardness and volume fraction of retained austenite (V_γ) were measured in all of the as-cast and subcritically heat-treated specimens. In the as-cast state, the hardness decreased gradually but the V_γ increased greatly as Mo content increased in both 16 and 26 wt% Cr cast irons. In the state of subcritical heat treatment, the hardness increased first and then decreased with an increase in holding time. It is due to a secondary hardening caused by the precipitation of secondary carbides and the martensite transformed from the destabilized austenite during cooling. At the same Mo content, the degree of secondary hardening was greater in the 16 wt% Cr cast iron than in the 26 wt% Cr cast iron. The V_γ decreased with increasing both of holding time and holding temperature. The maximum hardness in the subcritical heat treatment (H_{STmax}) was obtained when the specimens were treated at the temperatures from 823 K to 873 K for 50.4 ks. The H_{STmax} increased gradually in the 16 wt%Cr cast iron but it changed little in the 26 wt%Cr cast iron when Mo content was increased. The largest value of H_{STmax} , 760 HV30, was obtained in the 16 wt%Cr cast iron with 3 wt%Mo where the V_γ was less than 10%.

Keywords: *Hypoeutectic high chromium cast iron, subcritical heat treatment, hardness, volume fraction of retained austenite, Mo effect*