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Influence of Cobalt Content on Heat Treatment Behavior and Abrasive Wear Characteristics of Multi-Component White Cast Iron

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Abstract. Heat treatment characteristics of multi-component white cast irons varying Co content from 0 mass% to 10 mass% were investigated, and the effects of Co content and heat treatment conditions on abrasive wear resistance were clarified using a two-body type(Suga-type) abrasion wear tester. The test pieces with 55^{W} x 55^{H} x 6^{T} mm in size were cut off from an ingot with 55^{W} x 55^{H} x 200^{L} mm which had been annealed at 1223K for 18ks. Hardening (1323K x 36ks-FAC) and tempering (673K~873K x 10.8ks-AC) were given to the test pieces. It was found that volume fraction of retained austenite (V_γ) of the as-cast and as-annealed specimens decreased with an increase in the Co content. However, any austenite could not be observed in the specimen with 10 mass % Co. In the hardened state, the V_γ of Co-free specimen was about 11 %. The V_γ decreased to 6 % with an addition of 2 mass % Co, but it didn't change even when Co content was increased over 2 mass%. The V_γ decreased with increasing the tempering temperature regardless of Co content and got to nil over 800K. Macro-hardness of specimens in the as-cast and as-annealed states decreased gradually with an increase in the Co content. In the as-hardened state, however, the hardness showed a slight decrease even when the Co content was increased up to 10 mass %. Secondary hardening occurred conspicuously in the tempered specimens regardless of the Co content, and the maximum tempered hardness (H_{Tmax}) rose as the Co content was increased. Abrasive wear resistance increased proportionally related to the hardness, being unrelated to the Co content.

Keywords: *multi-component white cast iron, cobalt, heat treatment, retained austenite, secondary hardening, abrasive wear resistance*