Contribution ID: **604** Type: **Oral**

Effect of Destabilisation and Tempering on Microstructure and Hardness of 28 wt.%Cr-(1-4) wt.%W Cast Irons

Tuesday, 22 May 2018 10:00 (15 minutes)

High chromium cast irons are widely used for wear-parts in the mining, mineral and cement industries, due to their high abrasion resistance, relative low cost and ease of production. Carbide-forming elements addition and heat treatments were improved their properties. In this work, the effects of W addition and heat treatment on the microstructure and hardness of nominal 28 wt.%Cr high chromium irons were studied. As-cast samples were destabilised at 1050 ^{o}C for 4 hours and then hardened by air cooling. Tempering after destabilisation was done at 450 ^{o}C for 4 hour and then air cooling. X-ray diffractometry, light microscopy and scanning electron microscopy were used to characterize the microstructures of the irons. Vickers macro-hardness was tested. The results show that the as-cast microstructure of the iron without W addition consisted of primary austenite dendrites with eutectic M_7C_3 and eutectic austenite partially transformed to martensite. The iron with (1-4) wt.%W addition were hypereutectic contained primary M_7C_3 and eutectic M_7C_3 in an austenite matrix. In the iron with 4 wt.%W, M_6C carbide was found. Destabilisation treatment of the austenite matrix allowed precipitation of secondary carbides and transformation to martensite during air cooling. After tempering, more secondary and tempered carbides precipitated within the matrix and eutectic austenite. After heat treatment, phase transformation of eutectic M_7C_3 was also found in the iron with (1-4) wt.%W addition. The formation of primary M_7C_3 and M_6C carbides in the iron with W addition increased the as-cast macro-hardness from 500 HV_{30} (no W) to 550 HV_{30} (4 wt.%W). Destabilisation increased the macro-hardness up to 740 HV_{30} (no W) and 870 HV_{30} (4 wt.%W), respectively. This is believed that secondary carbide precipitation allowed austenite to transform to essentially martensitic matrices. Tempering after destabilisation slightly increased the macro-hardness.

Keywords: High chromium iron, Heat treatment, Microstructure, Tungsten, Hardness

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Session Classification: A13: Material Physics

Track Classification: Material Physics and Functional Materials