

Microstructure and Properties of Cu-Bearing Hypereutectic High Chromium Cast Iron

Authors : Liqiang Gong, Hanguang Fu

Abstract : In order to further improve the wear resistance of Hypereutectic High Chromium Cast iron (HHCCI), the effects of different Cu contents on the microstructure and properties of HHCCI were systematically studied. It was found that with the increase of Cu content, the carbide size was refined, and the increase of Cu content led to the increase of austenite and the decrease of hardness in as-cast HHCCI. After heat treatment at 1050 °C, the hardness of HHCCI increased significantly compared with as-cast. And with the increase of Cu content, the hardness of HHCCI increased first and then decreased, and the hardness was the highest when 0.5 wt.% Cu was added. The increase of copper content promotes the precipitation of secondary carbides and makes the interface between α -Fe and M₂₃C₆-type secondary carbides a semi-coherent boundary. With the increase of Cu content, the wear loss of HHCCI decreased after heat treatment at 1050 °C, and the wear resistance improved. When the Cu content increased to 1.0 wt.%, the wear resistance of HHCCI was the best, which was 2.6 times that of copper-free HHCCI. The continued increase of copper content has no obvious effect on the wear resistance of HHCCI. In addition, a small amount of Cu tends to adsorb on the (0001) preferential growth surface of M₇C₃-type carbides, thereby refining the carbides. From the First-principles calculations, the solid solution strengthening effect of Cu on the matrix and the adsorption and refinement of carbides were revealed, and the influence mechanism on the wear resistance of HHCCI was characterized.

Keywords : hypereutectic high chromium cast iron, cu alloying, carbides, wear resistance, first-principles calculations

Conference Title : ICMMP 2023 : International Conference on Materials and Materials Processing

Conference Location : Prague, Czechia

Conference Dates : July 03-04, 2023