

Alloyed Chromium Irons

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High chromium irons are attracting attention as wear resistant material especially in thermal power plants which tend to fracture under impact for past three decades. Hence, various methods as to be employed to possess better impact behavior without sacrificing the wear resistance. To meet these demands, alloying chromium with elements such as nickel or copper or manganese has been carried out, owing to their tendency to favor austenite stabilization. Of these, manganese finds favor as ferro-alloys are available commercially and are less expensive compared to others elements. Investigation in this direction with the use of manganese up to 10 wt. % in chromium iron system have shown to yield better wear and impact performance. Further, a novel non-destructive testing method i.e., positron lifetime spectroscopy for characterizing the defect quantification has been attempted. The purpose of this study is to establish a correlation between tribological and positron lifetime spectroscopy parameters involving microstructural analysis. Keeping these factors in view, four broad objectives are framed as listed below for this investigation:

1. Influence of 5 % and 10 % manganese content on the tribological and impact properties.
2. Effect of metal and sand molds on the wear and impact characteristics as they provide different solidification rates.
3. Influence of different section thickness i.e., 12, 24 and 40 mm³ for 5 % and 10 % manganese content affecting its tribological and impact energy behavior as the cast section size influence the microstructural behavior because of the varied heat transfer properties at the mold wall and.
4. Their response to thermal treatment.

Thus, the work clearly demonstrates, the heat treatment affecting the wear and impact properties of alloyed chromium iron. Also, the 5 % heat treated manganese bearing chromium alloyed iron prepared in 12 mm section thickness metal mold displays the superior wear properties along with good impact behavior resulting in microstructural modifications (i.e., spheroidization of fine carbides in an austenitic matrix with minimum defect characteristics). Thus, heat treatment becomes a key factor in controlling the wear and other characteristics.