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Thesis Title : Electrochemical Corrosion Behaviour of Alloyed White Iron Containing
25-30 % Cr and 423 Ni-hard
Major Field : Industrial Chemistry
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Academic Year : 1999

Abstract

Abrasion resistant materials used in industry may need to be able to resist not only abrasion and impact loads but also corrosive environments. These materials can be divided into 2 main groups, non-metallic materials, alloyed steels and white irons. The latter group are widely used especially the high Cr white cast irons and Ni - hards (4%Ni) because of their combined abrasion & corrosion resistance. They can be cast to near net shape and may be used in as cast or heat-treated conditions. In many service application wear of these alloys involves complex interactions between abrasion and corrosion mechanisms.

The purpose of this thesis is to study the corrosion behaviour of 10% - 30% Cr white irons in order to compare the results with those from the limited amount of previous work. The present work has made use of new techniques and equipment. In particular the corrosion resistance of the 25 and 30 %Cr white irons in as cast and heat- treat conditions was examined by using potentiodynamic techniques in 3 different solutions, 0.5 M H_2SO_4 , mixed acid from a paper mill and a solution from a mining (base) industry. The potentiokinetic reactivation technique was used to study Cr depleted zones in the 25% and 30% Cr white irons in both as-cast and heat-treated condition. Attempts have been made to correlate the electrochemical results with microstructure in the 25 % Cr white iron, both as-cast and heat-treated, by the used of interval backward scans from higher to lower potentials. At suitable stages during this potential scan the microstructure of the specimens were examined.

It was found that the 10-20%Cr white irons and Ni-hard showed pseudopassive film. The heat-treated 25 - 30%Cr irons showed better corrosion resistance than the as-cast ones. From the intervals behaviour scan of the 25% Cr white iron, the chromium-depleted zones around carbide can clearly be seen using SEM. These zones were the first to dissolve, followed were by eutectic austenite and then primary austenite respectively. In the heat treated condition, the chromium depleted zones around eutectic carbides dissolved first but the effect was not so obvious as in the as cast structure. The martensitic matrix dissolved more uniformly than the austenitic in the as cast structure due to the presence of the secondary carbides, which became gradually detached from the matrix and removed into the solution

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