ABSTRACT

Porous structures have become an attractive research field both from a scientific viewpoint and the prospect of industrial applications. They have very high porosity level and exceptionally light weight materials and provide tool for the realisation of optimal combination of properties.

Porous structures are known for their interesting combinations of physical and mechanical properties such as high stiffness in conjunction with very low specific weight or high compression strength. They are less conductive than solid metal and easily recyclable back into the original metal making them reusable.

This research work deals with the special interest in formation of porosity in the cast materials especially in gray cast iron. It contains carbon in the form of flake graphite in a matrix which consists of ferrite, pearlite or a mixture of the two. A technique has been developed for preparation of Porous gray cast iron metal foam using sand balls of various sizes. The technique is based on casting metal around granules. To check its stability, hardness testing has done with non-porous gray cast iron which was 242 HBN and porous gray cast iron was 218 HBN.

Since the mechanical properties of metallic foams depend largely on the density, it was found out, where minimum weight gave maximum percentage porosity as 72.08, with a weight of 4 kg, at a temperature of 1385°C. Inspection methods like Radiography found that there is no mass

segregation of the metal at any place in the casting. Cut section analysis was done on the porous sample, it is a visual inspection method of castings which reveal the interconnectivity of the pores and the pore sizes. Porous structures also provide enhanced resistance to damage or sudden fracture, as the open structures can absorb large tensile and compressive strains. Compression test, it was identified that due to porosity, a minimum load of 325 KN was utilized to compress the porous piece whereas maximum load for non-porous model it was above 1400 KN.

Metallographic examination gave an insight into the pore structure, which reveals information on pore distribution and the interconnections of the open cells. Scanning Electron Microscope gave the information regarding the fractured surface of porous gray cast iron. By using the Box-behnken design, matrix was formed and optimization was done which gave good results. Predicted values and obtained values were in good agreement with the experimental values.