ABSTRACT

The development of porous castings has become attractive to researchers in recent years, both in scientific and industrial applications. In past, any kind of pore in the metal was considered defective, but same class of materials with pores are now getting importance due to their unique combination of physical and mechanical properties such as high stiffness, low specific weight, unusual acoustic properties, high impact absorption capacity and good electrical insulating properties.

Since inception several processes have been developed to introduce large size pores, almost uniformly distributed in metallic materials. The stability of cell structure during foaming process has also been a concern. Therefore methods have been explored to increase the stability by addition of alloying elements and introduction of ceramic materials. Efforts are being made to achieve foams with reliable properties at low cost. These structures combine a relative stiffness and strength with low density and are mostly used in situations where weight reduction is required.

The main aim of the research is to check the possibility of production of porous castings in all types of metals. For this research one low melting material aluminium, one medium melting material gunmetal and one high melting point material stainless steel was selected. This research work deals with the formation of porosity in gunmetal, stainless steel and aluminium

castings. A technique has been developed for production of porous castings in all the three metallic materials using sand balls of various sizes, by implementing casting metal around granules. Visual examination on all the porous castings of gunmetal, stainless steel and aluminium castings were conducted. The visual examination confirms the formation of pores evenly on the surfaces of the castings.

Radiography tests were carried out on all the samples of porous gunmetal, stainless steel and aluminium castings. Test results confirm that there was no mass segregation of the metal at any place of the casting. Since mechanical properties of metallic foams largely depend on the density. It was found from the density measurement of porous gunmetal castings that the percentage of porosity was maximum at 62.15%, when the density was minimum at $3.30x10^{-6}$ $kgmm^{-3}$ with weight at 4.85 kg. For density measurement of porous stainless steel castings, the percentage of porosity was maximum at 54.08%, when the density was minimum at $3.60x10^{-6}$ $kgmm^{-3}$ with weight at 13.50 kg. In the density measurement of porous aluminium castings, the percentage of porosity was maximum at 57.73%, when the density was minimum at $1.12x10^{-6}$ $kgmm^{-3}$ at weight at 4.23 kg.

Visual examination of cut-section on all porous gunmetal castings reveals the interconnectivity of the pores and the pore sizes. From the compression test on porous gunmetal castings, it was identified that due to porosity a minimum load of 169 KN was utilized to compress the porous piece compared to a maximum load for non-porous model at above 1400 KN.

To check the stability, hardness testing was done on all porous gunmetal castings.

This research clearly reveals the fact that porous castings of desired porosity can be produced by casting around granules.