ABSTRACT

The present investigation deals with production of water atomized white cast iron powders as well as iron powders from sponge iron fines. To study their various characteristics for making use of these in traditional P/M industries to manufacture machine components and finally to use these two powders to manufacture metal matrix composites.

Sponge iron fines were melted in an arc furnace at 1650^{0}C to produce cast iron. The cast iron again was remelted by induction furnace 1700^{0}C and finally water atomized to white cast iron as well as iron powders. Water atomized white cast iron powders were also produced by induction melting of mild steel scrap. All the above powders were characterized and tested for chemical analysis, hydrogen annealing cooling rate analysis, apparent density, flow rate, true density particle analysis, SEM , XRD and DTA studies, cold compaction and sintering studies etc. The characteristics of both the cast iron powders were compared and found that many of the characteristics of the cast iron powders from sponge iron fines were similar with that from mild steel.

The compressibility of white cast iron powders which were annealed at 700^{0}C was very low for cold compaction. By hydrogen annealing at 900^{0}C for 30 minutes surface decarburization took place in cast iron powders and then the compressibility improved. No significant grain growth was observed in rapidly solidified cast iron powders by heating at 900^{0}C for 30 minutes .

The sintered densities of white cast iron powders were found to be lower than green densities, for sintering temperature ranging from 720^{0}C to 1000^{0}C. The growth rate in case of compacts from cast iron powders from sponge iron fines was increased from 4% to 8% when the sintering temperature increased from 720^0 C to 1000^{0}C.

The 700^{0}C hydrogen annealed powders when thermo mechanically processed within temperature range of 700^{0}C to 750^{0}C showed very fine grained iron carbide and ferrite structure in the processed material. During processing very good bonding

between cast iron powders and mild steel sheets was developed, The microstructure of mild steel portion was also converted to fine grained carbide ferrite structures. By Vickers hardness testing 490 VHN hardness was recorded in the fine grained carbide ferrite structured material.

White cast iron powders and iron powers were mixed in 50:50 ratio and after proper blending consolidated following two different methods like conventional die compaction and sintering method as well as encapsulation thermo mechanical method to produce two different types of metal matrix composites. By SEM analysis it was revealed that both the composites are suitable for making high performance machine components.

During cold compaction of the above mentioned powders cracks were observed in powder particles due to over compaction pressure. Acoustic emission technique was adopted to optimize compaction pressure to prevent particle cracking inside the die It was revealed that there is a direct relation of compaction pressure with acoustic emission amplitude.