ABSTRACT

An attempt has been made to study the effects of microalloying elements like Ti, V and Nb on the structures and properties of cast irons. The idea was to examine whether some of the beneficial effects of microalloying elements, as observed in case of cast steels, may also be realised in cast irons. Accordingly, grey cast iron was microalloyed separately with Ti and Nb upto 0.1 % and 0.07 % respectively and the corresponding effects on mechanical properties and wear characteristics were studied. Ductile irons microalloyed separately with V upto 0.1 % and Nb upto 0.043 %, along with about 1.4 % Ni were austempered (austenitised at 900 °C for 1 hour followed by austempering at 335 °C for 1.5 hour). The effects of the microalloying elements on the mechanical properties, wear characteristics, austemperability and weldability of such austempered ductile irons were examined. Adhesive wear tests were carried out on a pin on disc type machine under wear loads of 29.4 N, 39.2 N and 49.0 N. Flash butt welding process was used for joining ADI specimens. Brazing of ADI specimens was done manually using Cu:Zn (50:50) filler metal.

Studies on microalloyed grey cast irons revealed that addition of 0.1 % Ti or 0.07 % Nb improves the tensile strength of the iron marginally whereas the corresponding improvement in wear resistance is remarkable. Ti or Nb reduces the dendrite arm spacing of grey cast iron although there is no remarkable effect on the hardness value.

Studies on microalloyed ADI confirmed that microalloying with 0.1 % V or 0.043 % Nb, along with about 1.4 % Ni improves its tensile strength significantly and it is superior to that of the standard ADI alloyed with 0.3 % Mo along with about 1.4 % Ni. The wear resistance of ADI improves remarkably after microalloying with 0.1 % V or 0.043 % Nb, along with about 1.4 % Ni approx. The wear resistance of microalloyed ADI is superior to that of the standard ADI. The austempering response of microalloyed ADIs is almost the same or rather better than that of the standard ADI. The impact energies of ADI samples suffer appreciable deterioration after joining by flash welding and the same improve when the samples are subjected to post-weld austempering treatment. Joining by brazing causes less damage comparatively. In this respect the effects of welding and brazing are identical in both microalloyed ADI and standard ADI.