

ABSTRACT

A comprehensive study on wear, thermal reversion and welding characteristics of Austempered Ductile Iron (ADI) is presented in the thesis with supporting illustrations. At the outset three commercial grades of ductile iron with copper as a major alloying element were successfully melted and cast. It was followed by austempering heat treatment. The present work embodies three stages. Firstly adhesive wear tests are performed with pin and disc type wear testing machine. In order to study the micromechanisms involved thermocouple inserted specimens are tested under different loads varying from 17.17N to 66.22N. At lower wear loads copper grade ADIs display higher wear resistances than the unalloyed ones. The prominence of oxidative type wear under lower loads is noteworthy. Under higher loads graphite smearing effect is predominant. Laminative delaminative type wear takes place under very high wear loads. Work hardening of ADI occurs during adhesive wear mostly due to the formation of stress-induced martensite.

The second series of experiments have been carried out using dilatometry for studying the reactions that take place during thermal reversion of ADI. Similar heat treatments are conducted in salt-bath. During thermal

reversion of ADI the sequences of phase transformations involved are precipitation of iron silico carbides, their graphitisation, copper precipitation and growth of copper precipitates, if copper is present in the alloy. Increase in copper content of ADI delays the progress of thermal reversion.

Final series of experiments have been carried out for joining ADI parts through flash butt welding and brazing, post-welding heat treatments are also performed. ADI-welds followed by austempering heat treatment and S.G.I.-welds followed by austempering heat treatment exhibit very low deterioration of the impact strength. During brazing process the deterioration of impact strength is limited to about 20%, due to copper and zinc diffusion into the ADI specimens. Very high deterioration of impact strength occurs with ADI-welds followed by tempering at 175°C for 15 minutes. All these results throw light on the various characteristics of ADI indicated above.