CHAPTER 7

CONCLUSIONS

7.1 INTRODUCTION

This chapter presents the major conclusions arrived at from the present research work which involved the fabrication of AA6061/Fly ash MMC using compocasting method, dry sliding wear behavior of the compocast composite and application of GTA welding process to join the fabricated AMC. The scope for future work to expand the present work is also provided at the end of the chapter.

7.2 THESIS CONTRIBUTIONS

AA6061 alloy reinforced with fly ash metal matrix composites were successfully fabricated by compocating technique. SEM micrographs and XRD patterns clearly revealed the presence of fly ash particles. No intermediate phases were formed due to proper selection of the compocasting technique. Fly ash particles were found to have uniform distribution in the matrix, spherical in shape, good bonding and clear interface. The maximum content of fly ash was limited to 12 wt.% due to the formation of excessive porosity and slag in the fabricated MMC. Increased content of fly ash particles in matrix alloy resulted in higher hardness and ultimate tensile strength of the composites. Addition of 12 wt.% fly ash particles increased the microhardness from 47 HV to 113 HV and UTS from 149 MPa to 242 MPa respectively. Fly ash reduced the elongation and wear resistance of the matrix alloy. Addition of 12 wt.% Fly ash particles reduced the elongation from 13.8 % to 5.1 % respectively.
The dry sliding wear behavior of AA6061/fly ash MMC was evaluated using a Pin-on-disc apparatus. The compocasted fly ash particles improved the wear resistance of the composite. The wear rate of AA6061/12 wt.% fly ash MMC and AA6061 were $832.7 \times 10^{-5}$ mm$^3$/m and $2491.2 \times 10^{-5}$ mm$^3$/m respectively. The dry sliding wear behavior of AA6061/fly ash MMC was found to be non linear. The wear parameters sliding velocity, sliding distance and normal load were proportional to the wear rate. The worn surfaces revealed an increase in number of cracks when sliding velocity, sliding distance and normal load were increased. The worn surface of AA6061/fly ash MMC showed that the wear mode was abrasive.

Tungsten Inert gas welding was successfully applied to join AA6061/fly ash MMC composite. TIG welded AA6061/Fly ash MMC joint exhibited the presence of different zones such as weld zone and heat affected zone. The width of the heat affected zone in the parent metal were reduced with increase in the content of fly ash particles. Due to reduction in area of HAZ which enhances the tensile strength of 251.7 MPa for IEA welds and 227 MPa for the DEA welds. The DEA weld zone shows due to the incorporation of fly ash particles into the weld which leads to the dissolution of Fly ash particles to react with molten aluminium to form the intermetallic components which considerably lowers the tensile strength of the DEA weldments. Due to the presence porosity in the DEA weldments which leads to determined the failure during tensile testing. Where the IEA joint technique appears to be alternative for direct electric arc welding of Al–Fly ash composites with a minimal area of HAZ.

7.3 SCOPE FOR FUTURE WORK

- Al/Fly ash-based composites could be developed with higher amount of reinforcements in more by stir casting technique to enhance mechanical properties further.
• Details study of the wear behavior is to be carried out for all the casted specimens.

• Post- and pre-creep testing microstructure investigations need to be carried out to understand the strengthening mechanism of fly ash addition in AA6061 alloy.

• A detailed TEM investigation is required to understand the crystallographic matching between nucleant and AA6061 matrix.

• Different coatings can be identified to improve the corrosion resistance of the composites.

• Joint properties of TIG welded AA6061/Fly ash MMC can be compared with similar joints made by other fusion welding and solid state welding processes.

• Research on other secondary processing such as cutting, forming and machining of AA6061/Fly ash MMC can be carried out.