CHAPTER 6

CONCLUSIONS AND FUTURE SCOPE

6.1 SUMMARY

LM13-SiC composites and LM13-SiC-Gr hybrid composites are fabricated by compocasting process. Characterisation study was performed to analyse the distribution of particles and elemental analysis in the composites. The mechanical and dry sliding wear tests were conducted to analyse the mechanical and wear behaviour of composites. The experimental results are predicted and optimized for minimum response using RSM. Thus the following conclusions are drawn from the present investigations

1. The compocasting process enhances the wettability between aluminium matrix and reinforcements which are revealed by SEM and EDS images.

2. It was observed the micro and macro hardness of LM13-SiC and LM13-SiC-4Gr composites increased compared to the base matrix and it increases gradually with increase in wt. % of SiC and constant graphite particles. This increase is due to the addition of reinforcement particles, which increases the dislocation density during solidification creates more resistance to plastic deformation results in enhanced hardness.

3. The micro hardness of LM13-SiC composite increased from 130 VHN to 160 VHN and macro hardness increased from 105 HRC to 130 HRC respectively. It was observed the hardness increased by 5% for every 3 wt% addition of SiC particles.
4. The micro hardness of LM13-SiC-Gr composite increased from 130 VHN to 159 VHN and macro hardness increased from 105 HRC to 129 HRC respectively. The hardness increased by 2% for every 3 wt% addition of SiC particles and constant 4 wt% Gr particles.

5. It was observed the micro and macro hardness of LM13-SiC-4Gr hybrid composite decreased compared to LM13-SiC composite. This is due to the addition of graphite particles which is a soft reinforcement with low density tends to float in the melt results in weak bonding exhibits a non-uniform distribution of graphite particles in the matrix.

6. The ultimate tensile strength of LM13-SiC and LM13-SiC-4Gr composites increased compared to the base matrix and it increases gradually with increase in wt. % of SiC and constant graphite particles. This is mainly due to difference in coefficient of thermal expansion (CTE) between matrix and reinforcements. Even a small temperature change generates thermal stresses in composites leads to increase in dislocation density hence increases strength of composites.

7. The ultimate tensile strength of LM13-SiC composite increased from 192.8 Mpa to 214.2 MPa for every 3 wt% addition of SiC particles. Similarly the ultimate tensile strength of LM13-SiC-Gr hybrid composite increased from 192.8 Mpa to 218.3 Mpa for every 3 wt% addition of SiC particles and constant 4 wt% Gr particles. It was observed the strength increased very minimally for every wt% addition of reinforcements.

8. It was observed the ultimate tensile strength of LM13-SiC-4Gr hybrid composite is marginally increased compared to LM13-SiC composite. This is mainly due to the increase in particle content which reduces the interspatial distance between the particles in the matrix causes an increase in dislocation pile-up. This leads to restricted plastic flow which enhances the tensile strength of composites.

9. The wear resistance of LM13-SiC composite is high compared to base matrix and it increased with increase in wt. % of SiC in composite.
10. The wear resistance of LM13-SiC-Gr hybrid composite increased with increase in wt. % of SiC and 4 wt. % graphite particles but it is found to be higher than LM13-SiC composite.

11. The wear rate reduces with increase in sliding speed, sliding distance and reinforcement wt. % but it increases with increase in normal load.

12. The regression analysis indicates normal load is the most influencing wear parameter followed by reinforcement wt %, sliding distance and sliding speed on wear rate of composites.

13. The confirmation experiment shows the error between experimental and predicted model lies within the range of ± 5% for the response.

6.2 FUTURE SCOPE

1. This study was conducted to analyse the dry sliding Wear behaviour of composites. A study may be conducted in wet environments also.

2. Erosive and adhesive wear study may be conducted with the same matrix and reinforcements.

3. In this study the composites were produced using compocasting method. However other casting techniques may be used to conclude the best casting process.

4. In this study, of 1wt. % of Mg metal powder was used to enhance the wetting process. However higher wt. % may also be used to analyse the wetting behaviour. Moreover other binding alloys can also be tried for better wetting.

5. Heat treatment and corrosion study may be conducted with the composites.

6. Since this is a preliminary investigations carried out to find an alternative material for automotive engine piston. A composite piston can be produced with the same matrix and reinforcements and wear tests may be conducted in an actual piston test rig.