CHAPTER 6

CONCLUSIONS

From the detailed results of the present research work, the conclusions arrived at are:

1. A CDC equipment was successfully designed and locally fabricated. Al-Si alloys with functionally gradient in Si concentration were successfully produced using the in-house designed and fabricated unit.

2. Using CDC process, a wide range of FG layers showing gradient in the concentration of Si particles at the interface between high Si and pure Al or low Si FGM castings have been produced in metal mold and sand mold. All the four FGM castings displayed three distinct layers: outer layer, FG layer and inner layer without defects as required for FG material.

3. The thickness of FG layer in FGM castings was optimized by CDC process in metal mold and sand mold. A maximum FG layer thickness of about 67 µm for 20 seconds in metal mold and of 74 µm for 60 seconds in sand mold was obtained.
4. A distinct microstructure having FG zone at the interface between high Si layer and low Si or pure Al layer in all the FGM castings was confirmed clearly by optical microscope.

5. A clear transition layer containing gradient in Si content was observed in all the FGM castings by EDS analysis. The results of SEM analysis showed that the volume of Si particles in FG layer decreased gradually with distance from the outer surface. The FGM castings produced in metal mold reveal very fine Si particles than the FGM castings in sand mold.

6. The hardness of the FG layer in all four FGM castings produced by metal mold and sand mold was found to continuously decrease with increase in sliding distance. The highest hardness of 120 VHN was observed for outer layer in FGM 4 casting by metal mold. The variation of hardness across the cross section of the FGM castings corresponds to change in Si concentrations.

7. Wear volume and wear rate of FG layers were found to be similar with the outer layer in FGM castings produced by metal molds and sand molds. The wear resistance of FG layer in FGM 4 casting (Al-12.5 wt % Si with Al-4.5 wt % Si) produced by metal mold was found to be better than the inner and outer layer at higher sliding distance of 20 km.

8. Corrosion rate of inner layer in the FGM castings is lower as compared to outer layer and FG layer in FGM castings with the same chemical compositions. The reduced corrosion rate is attributed to the presence of pure Al matrix or less Si content in the matrix.
9. The present study conclusively proves that the CDC process using locally designed and fabricated equipment can be successfully used to fabricate FGM alloys.