Overall Conclusions

Thermal cycling of a hypoeutectic Al-10Cu alloy showed distribution of isolated droplets in the primary solid phase. Initial stages of thermal cycling resulted in liquid along the grain boundaries. However, in subsequent thermal cycling, the continuity of the grain boundary liquid was observed to break down to discontinuous liquid which formed isolated droplets. The solidification structure of continuous liquid exhibited regular eutectic in contrast to particulate eutectic microstructure of the isolated droplets. Distribution of droplets and their resultant solidification structure led to an improvement in the wear property of the alloy compared to the alloy processed by normal casting route.

In rheocasting the primary α - phase is changed from dendritic to nearly spheroidal morphology arsing from stirring action of the melt. The finer grain size of primary α - phase was observed at maximum rotational speed of 1200 rpm. This observation of increased grain refinement with higher stirring speeds can be rationalized by increased fragmentation and uniform distribution of solid particles in the slurry at higher stirring speeds resulting into pronounced decrease in grain size. The cumulative volume loss of all alloys increased with increase in load irrespective of the processing method. The coefficient of friction values for rheocast samples were observed to be less than the metal mould cast alloy. The wear rate of metal mould cast alloy rapidly increased beyond 3 m/s sliding velocity. For rheocast alloys, 4 m/s is critical sliding velocity and beyond this wear rate is increased drastically.

In the SIMA process a cast alloy was subjected to warm working at 300 ºC and intercritically annealed at 580 ºC in two phase solid-liquid region. The result revealed accelerated spheroidization of the primary α- phase. The size of the spheroids varied from 45 to 60 µm. Analysis of wear track surfaces brought out a clear evidence of co-existing

abrasion and adhesion mechanisms of material removal during tribological study of SIMA processed alloy.

In centrifugal casting the optimum mould speed was found to be 1980 rpm as it produced fine microstructure in the casting resulting in optimum hardness, ultimate tensile strength and wear rate.

Scope of the Future Work

- SIMA process of the Al-10Cu alloy can be studied by varying the semi-solid temperatures and deformation percentages.
- Rheocasting of Al-10Cu alloy can be studied by producing at different semi-solid pouring temperatures and stirring time.
- The effect of liquid droplets distribution in the solid matrix on the mechanical and wear properties of other alloys can be studied
- An attempt can be made to produce semi-solid centrifugal casting for achieving good mechanical and wear properties.