

Chapter 5. Future Work

Based on this work, some suggestions for the further work are as follows: Although better understanding of the mechanism of the cure reaction of vinyl ester resins has been achieved through this work, further studies are needed. Many questions concerning the mechanism of the vinyl ester cure reaction remain unsolved. For examples, the ratio of pendent groups has not been determined during the cure reaction. At high temperature cure, the rate of cure reaction was very fast and almost 100% conversion can be approached. However, final products obtained at high temperature usually have more cracks compared to those obtained at lower temperature cure. On the other hand, it was found that the gels and sols phase separation occurs at an early stage of conversion at high temperature. However, at room temperature cure, the phase separation was not observed. Future work needs to be focused on the comparison of the kinetics of the cure reaction at low (room) temperature with the kinetics at high temperature and to relate these kinetics to the properties of the resulting matrices.

In this work the volume shrinkage of vinyl ester resins was measured only by using the simple density measurement. Shrinkage needs to be measured by using dilatometry, so that the shrinkage over the entire cure reaction can be monitored.

The toughness of vinyl ester resins increased dramatically when the molecular weight of vinyl ester oligomers increased. This implies that the vinyl ester resins may be toughened by mixing high molecular weight oligomers with low viscosity vinyl ester oligomers. Future work is suggested to synthesize new low viscosity and long chain vinyl ester resins through chain extension. Long chain polyester alcohols can be obtained by reacting propoxylated bisphenol-A with various acids. The new vinyl ester resin can be prepared by methacrylation of the long chain polyester alcohols. These new vinyl ester resins may be used to improve toughness of vinyl ester resins.

Another interesting area is to use other comonomers with the vinyl ester resins and study the effect of the comonomer on the interface properties. Hopefully the comonomer can improve interface bonding between the vinyl ester and carbon fibers.