

CHAPTER V

CONCLUSIONS

5.1 Conclusions

In this work, the electrospinning technique was used to produce PS fibers. The effects of process conditions and solvent system on morphological appearance of submicron PS fibers were thoroughly investigated. PS solutions were prepared in both single solvent systems and mixed solvent systems. The fiber diameter and morphological appearance appear to depend not only on solution parameters such as viscosity, conductivity, and surface tension, but also on properties of solvent through its impact on the final fibers. The electrospinnability of the solutions was found to increase with high boiling point, high dipole moment, high dielectric constant, high difference in the solubility parameter, and high viscosity. Furthermore, PS fiber is influenced strongly by process conditions such as applied voltage, collection distance, and emitting electrode polarity, the charge density of the solution (by salt addition) and the properties of the solution such as concentration, viscosity, conductivity, and surface tension. There was an increase in average fiber diameter with increasing applied voltage and decreasing collection distance. With increasing concentration of PS solution, the morphology changed from beaded fiber to uniform fiber structure. For mixed solvent systems, the average fiber diameters of the as-spun fibers were found to decrease with increasing content of the second solvent. At high compositional ratios (i.e. greater than 50% (v/v)) and high concentration (i.e. 30% (w/v)), fiber of rough surface and fused fibers were observed.

5.2 Recommendations

The effect of process condition and solvent system for electrospinning of polystyrene solutions on diameter and morphological appearance of the as-spun fiber have been investigated in this work. The effect of ambience conditions (temperature, pressure, and humidity) on diameters and morphological appearance of obtained fibers are interesting for further investigation to provide clarification and more

understanding of the electrospinning process. Due to the influence of ambience conditions on jet formation, diameter and morphological appearance by evaporation rate of solvent and thermal properties of the polymer used. It would also be interesting to look at the diameter, morphological appearance of fibers, crystalline structure of the fiber, and mechanical property of fiber of polystyrene fibers when spun near the glass transition temperature of the polymer.

In this work, it must be noted that electrospinning setup used a single syringe. This limits production of thick fiber mat within short spinning time. In order to transfer this material to industrial applications, mass production electrospinning set-up has to be adopted. Therefore, a multi-syringes electrospinning set-up may be used to achieve large quantity of fibers within short spinning time. Using this set-up, the jet formation, diameter, morphological appearance, and arrangement of syringes are needed to be studied.