CHAPTER VI
CONCLUSIONS

In the present study, poly(3-thiophene acetic acid) was synthesized via oxidative polymerization by using ferric chloride as an oxidant and blended with polyisoprene rubber. Electrorheological properties of pure polyisoprene and polythiophene/polyisoprene blends were investigated through the dynamic moduli, G' and G" under the oscillatory shear mode by examining the effects of crosslinking ratio, electric field at various from 0 to 2 kV/mm, and polythiophene particle concentration. The storage modulus (G') increased but the loss modulus (G") decreased with increasing crosslinking ratio. The storage modulus (G') and the loss modulus (G") of the pure polyisoprene fluid exhibited no value change with increasing electric field strength. For polyisoprenes with the crosslinking ratios of 2, 3, 5 and 7, the storage modulus increased with electric field strength. The maximum G' sensitivity was found to be 0.6 for the PI_03 system. For the electrorheological properties of Pth_U/PI_03 blend, with the undoped particle concentrations of 5%, 10%, 20% and 30 %vol., the dynamic moduli, G' and G" of each blend were generally higher than those of pure polyisoprene as a result of the presence of polythiophene particles within the matrix acting as fillers; they can store or absorb the forces/stresses within the matrix. The storage modulus sensitivity, $\frac{\Delta G'}{G'_0}$ increased with electric filed strength. Both polyisoprene and polythiophene particles become polarized creating induced dipole moments leading to intermolecular and interparticle interactions. The G' sensitivity attained maximum values of 0.5, 0.35, 1.10 and 0.45 at the electric field strength of 2 kV/mm, respectively.

Electrorheological properties (ER fluid) of polythiophiene/polyisoprene suspensions were investigated by examining the effects of particle conductivity and particle concentration at electric field strength varying from 0 to 2 kV/mm under the oscillatory shear mode. Poly(3-thiophene acetic acid) particles were synthesized and doped with perchloric acid. The results show that the ER responses can be enhanced with increasing the electric field strength, the particle conductivity, and the particle concentration. The storage modulus (G') increased dramatically by 6 orders of magnitude when the electric field strength was increased to 2 kV/mm. This suspension exhibited a transition from a fluid-like to a solid-like behavior as the field strength is increased. The influence of particle conductivity and particle concentration are most apparent at intermediate field strength of 0.5 kV/mm. This suggests a change in the polarizability and agglomeration of particulate dispersions at high field strength, a, high conductivity, and high particle concentration. In the absence of the electric field, the particles were randomly dispersed in the suspensions. The particles became polarized creating induced dipole moment, leading to interparticle attractions which resulted in the formation of chin-like or fibrillar agglomerates in the direction of electric field. Higher electric field strength, particle conductivity and particle concentration induced a higher dipole moment and caused particle chains to pull themselves together tighter and formed thicker agglomerates or more fibrillation. The higher particle conductivity and particle concentration resulted in the lower sol-to-gel transition field strength.