

CHAPTER IV

CONCLUSIONS

Polyaniline emeraldine base was synthesized by chemical oxidation polymerization in the acid condition. The undoped and doped polyaniline thin films were prepared by using 1-methyl-2-pyrrolidone (NMP) as a solvent. The insulating form of polyaniline was protonated to the conducting form of polyaniline by using hydrochloric acid as a dopant. The doped polyaniline films were prepared by protonation doping in the solution.

The FTIR result showed that the intensity of the electronic band absorption at $1166\text{-}1135\text{ cm}^{-1}$ became broader with the increase in acid concentrations. The UV-visible result also shows the decrease in the absorption of quinoid segments with the increase in acid concentrations. The FTIR and UV-visible spectra indicate that the protonation at nitrogen atoms in the quinoid sites of polyaniline increase with acid concentrations. The UV-visible result of the doped polyaniline in the solution shows the peak at 665 nm, for the samples with C_a/C_p equal to 7.3 and 10.2, which is a longer wavelength than that of the doped polyaniline films. This is due to the change in molecular conformation of the doped polyaniline in the solution. The EA result shows that the doping levels of the doped polyaniline films increase with acid concentrations. The SEM result of the doped polyaniline in the solid form shows the change in morphology from compact coil to expanded structure with the increase in acid concentrations. The TGA result shows that the undoped and doped polyanilines have a good thermal stability at high temperatures in the range of $450\text{-}490^{\circ}\text{C}$. The electrical conductivity measurement shows that the decrease in the electrical conductivity of the doped films with time (days) is due to the oxidation from oxygen in air.

The oxidation process from oxygen reduces the localization length of the doped polyaniline and the reduction of the interchain electron diffusion rate to cause the decrease in the electrical conductivity. The electrical conductivity of the doped polyaniline films reaches the equilibrium within 20 days. The electrical conductivity of the doped films reaches the maximum at C_a/C_p equal to 14.6 and 30 due to the equilibrium protonation of the doped polyaniline and the delocalization of electron to conduct the conductivity in the interchain and intrachain directions. Beyond C_a/C_p equal to 30, the decrease in the electrical conductivity is due to the shorted delocalization length resulting from the over protonation.