CHAPTER V
CONCLUSIONS

5.1 Preparation of conducting plastic film by CVD of pyrrole.

Conducting plastic film can be prepared by CVD of pyrrole which was carried out in the dark under reduced pressure. The plastic film substrates of PVC, PP, and LDPE films were investigated for mechanical properties and electrical conductivity. To produce the conducting polymer, the catalyst's solution was coated on the substrate then the first conducting plastic film was obtained by starting polymerization of pyrrole on the substrate.

The conducting plastic films were carried out by varying many factors such as concentration of $FeCl_3$, concentration of pyrrole monomer, reaction temperature, reaction time, and iodine vapor doping. It can be concluded that, the most suitable condition is using reduced pressure in desiccator containing 25% by weight of $FeCl_3$ solution, 25% by volume of pyrrole monomer solution in distilled water by polymerizing at -15°C and 20 hours, and the electrical conductivity was obtained as as 1.61×10^{-1} S/cm. When the conducting plastic films were exposed with iodine crystal at -15°C about 60 minutes in reduced pressure, the electrical conductivity as very high as 26.45 S/cm. The electrical conductivities of this conducting plastic films were expected to be strongly dependent on the following three factors:

1) The types and ratio of polymer matrix which prepared metal/polymer matrix composite film coated on plastic film substrate.
2) The suitable reaction condition for CVD to generate polypyrrole on surface of plastic film.
3) Iodine doping condition.

The LDPE/PPY film should be chosen for high temperature applications, because the electrical conductivities were decreased as 40%, 42%, and 48% for LDPE/PPY, PP/PPY, and PVC/PPY films, respectively. At low temperature the electrical conductivity on various types of plastic film substrates were independent on the type of plastic films.

The CVD prepared conducting plastic films generally possess higher electrical conductivity and mechanical strength than those prepared via electrochemical and chemical solution. Furthermore, the use of the electrochemical polymerization is limited by size, shape, and nature of the electrode involved as well as the difficulty in preparing thick sheets, chemical solution method is supressed due to additive substrate dissolved into solution.

At low and ambient temperatures, the prepared conducting of PVC/PPY film is suitably chosen, and at higher temperature PP/PPY or LDPE/PPY is chosen because the PVC/PPY has poor mechanical strength and thermal stability at high temperature but very good at low and ambient temperatures. Additionally, LDPE/PPY or PP/PPY possess very good mechanical strength and thermal stability at high temperature. However, the prepared conducting plastic films were not homopolymers or copolymers, but polypyrrole was hardly coated on plastic films, it was clearly exhibited from DSC thermograms.

5.2 Suggestion.

From the observations, the prepared conducting plastic film has high electrical conductivity, however, after storing the prepared conducting films in open air at room temperature for a period of time and repeatedly measured their electrical conductivity, it was found that the electrical conductivity decreased gradually with time until it reached zero (see Appendix G). It is suggested that, to keep the

prepared conducting film in optimum conditions, the prepared conducting film should be kept in dark under reduced pressure at low temperature. The properties of prepared conducting plastic film can be improved through CVD method in order to obtain the highest electrical conductivity so that it may substitute for conductors or semiconductors in a wide variety of polymer substrates, polymer matrixes, reaction conditions, and doping conditions. The advantage of CVD method for producing the conducting film such as their light weight, less reaction time, and ease of manufacturing can be accomplished. It should be further studied in following aspects;

1) Effect of solvent on electrical conductivity of prepared conducting plastic film.
2) Effect of plastic substrates on electrical conductivity of prepared conductivity of prepared conducting plastic film.
3) Effect of ratio and different of matrix polymer on electrical conductivity of prepared conducting plastic film.
4) Effect of dopant and doping temperature on electrical conductivity of prepared conducting plastic film.