CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

In this study PPy/OC-MMT nanocomposites of 1-9 wt% OC-MMT were chemically synthesized. The nanocomposites prepared were the intercalated nanocomposites of OC-MMT and PPy with more number of expanded remaining Na-MMT but the one doping with DBSA was the combination of intercalated OC-MMT and exfoliated remaining Na-MMT nanocomposites. When using OC-MMT, PPy had much improved thermal resistance and moisture absorption (dependent on clay content) with higher degradation temperature and lower weight loss of 40% at 650°C while pure PPy had weight loss >80%. The obvious degradation of the nanocomposites began at about 300°C. The temperature at 10% weight loss of the pure PPy was around 180°C while that of the nanocomposites was about 290°C. With high loading of OC-MMT, the thermal behavior changed from one transition to two transitions; i.e. first fast degradation due to the loss of OC molecules and some parts of PPy followed by much slower second degradation due to further degradation of PPy. In the case of DPPyC3, however, it had better thermal resistance than the others with one transition. Moreover, the conductivity of PPy under ambient air atmosphere was enhanced by adding OC-MMT. The more content of OC-MMT, the more conductive the nanocomposites became. Addition of OC-MMT was more efficient in increasing the conductivity of PPy in ambient air than DBSA doping in the PPy nanocomposite with OC-MMT.

Response time and resistance of pure PPy and all the nanocomposite sensors to CO_2, CH_4, and C_2H_4 increased with an increase in the thickness of sample films. PPyC9 and DPPyC3 showed the lowest resistance to CO_2 and only PPyC9 to C_2H_4 while all samples except nDPPyC3 showed the lowest resistance to CH_4. The concentration of doping agent in the presence of clay did not affect the resistance of the nanocomposites. However, the doping contributed to enhance conductivity for the interested gases. For the mixtures of CO_2:CH_4 and CO_2:CH_4, resistance of pure

PPy and all the nanocomposites increased with increasing pressure of CH_4 and C_2H_4. The cross sensitivity for either gas in the systems of CO_2:CH_4 and CO_2:C_2H_4 was not much different and closed to 1, suggesting that these samples are good sensors but not selective for these gases.

Recommendations for future work

In this work, PPy/OC-MMT nanocomposites of 1-9 wt% OC-MMT are good sensors for CO_2, CH_4, and C_2H_4, however, they are not selective for these gases. It can be expected that size of gas molecules can affect the absorption of these gases in nanocomposite sensors. Therefore, the study of absorption mechanism will be the subject of the further investigation.