Study on Pyrolysis of Waste Plastics in Notebook Computer

林建興、吳照雄

E-mail: 9314405@mail.dyu.edu.tw

ABSTRACT

Abstract When the information products were discarded, it will cause the influence to the environment if there are not treated properly. The plastic in notebook computer is one of the information wastes. If we can treat these plastics with the pyrolysis method and convert the plastics into useful materials, it will be very helpful to the recycling of the resources. The plastics in notebook computer are composed of polycarbonate/acrylonitrile-butadiene-styrene (PC/ABS).The principal elements in PC/ABS were analysed by Elemental Analyzer (EA). The results indicated that the percentages of carbon, hydrogen, nitrogen and oxygen were 76.18, 5.73, 0.92, and 16.8%, respectively. The analyses of the kinetics of ABS pyrolysis in nitrogen/air were performed at the heating rates of 2, 5, and 10°C/min, respectively. The kinetic parameters were obtained by the weight-losing curves. The pyrolysis of PC/ABS in nitrogen/air can be expressed by the overall rate equations, respectively, as: in nitrogen dX/dt = 0.44dX1/dt + 0.56dX2/dt dX1/dt = 1.73×1010(1-X1)0.67exp(-36.4/RT) dX2/dt = 3.33×1012(1-X2)0.72exp(-46.6/RT) in air dX/dt = 0.4dX1/dt + 0.3dX2/dt + 0.3dX3/dt dX1/dt = 1.33×107(1-X1)0.69exp(-25/RT) dX2/dt = 3.6×108(1-X2)0.57exp(-30.7/RT) dX3/dt = 6011(1-X3)0.51exp(-19/RT) The products of the analysis of waste plastics in notebook computer includes gas, oil, and residue, which the percentage were 29, 52, and 19%, respectively, by the pyrolysis in nitrogen. Key Words：pyrolysis、PC/ABS

Keywords : pyrolysis ; PC/ABS

Table of Contents

REFERENCES

參考文獻 1. www.epa.gov.tw 2. www.niea.gov.tw 3. www.nchu.edu.tw/~rict/ 4. www.niea.gov.tw/niea/REFUSE/R40420C.htm 5. www.emfuel.com/big5/data/oildata.htm 6. Buekens, A. G. and Huang, H.,“ Catalytic plastics cracking for recovery of gasoline-range hydrocarbons from municipal plastic wastes,” Resources, Conservation and Recycling, Vol. 23, PP. 163~181 (1998). 7. Chen, F. Z. and Qian, J. L.,“ Studies on the thermal degradation of polybutadiene,” Fuel Processing Technology, Vol. 67, PP. 53~60 (2000). 8. Day M., Cooney J. and MacKinnon.,“ Degradation of Contaminated Plastics : A Kinetic Study,” Polymer Degradation and Stability, Vol. 48, PP. 341~349 (1995). 9. Day, M., Cooney, J. D. and Touchette, B. C.,“ Pyrolysis of mixed plastics used in the electronics industry,” Journal of Analytical and Applied Pyrolysis, Vol. 52, PP. 199~224 (1999). 10.Dong, D., Tasaka, S., Aikawa, S., Kamiya, S., Inagaki, N. and Inoue, Y.,“ The thermal degradation of acrylonitrile-butadiene-styrene terpolymer in bean oil,” Polymer Degradation and Stability, Vol. 73, PP. 319~326 (2001). 11.Herrera, M., Matuschek, G. and Kettrup, A.,“ Fast identification of polymer additives by pyrolysis-gas chromatography/mass spectrometry,” Journal of Analytical and Applied Pyrolysis, Vol. 70, PP. 35~42 (2003). 12.Kaminsky, W., Schlesselmann, B., and Simon, C. M.,“ Thermal degradation of mixed plastic wastes to aromatics and gas,” Polymer Degradation and Stability, Vol. 53, PP. 189~197 (1996). 13.Kaminsky, W. and Kim, J. S.,“ Pyrolysis of mixed plastics into aromatics,” Journal of Analytical and Applied Pyrolysis, Vol. 51, PP. 127~134 (1998). 14.Lu, L. F., Price, D., Milnes, G. J., Carty, P. and White, S.,“ GC/MS studies of ABS/CPVC blends,” Polymer Degradation and Stability, Vol. 64, PP. 601~603 (1999). 15.Mihai, B., Uddin, M. A., Akinori, M., Yusaku, S. and Cornelia, V.,“ The role of temperature program and catalytic system on the

quality of acrylonitrile/butadiene/styrene oil, ” Journal of Analytical and Applied Pyrolysis, Vol. 63, PP. 43~57 (2002). 16.Nishizaki, H., Yoshida, K. and Wang, J. H., “ Comparative study of various methods for thermogravimetric analysis of polystyrene, ” Journal of Applied Polymer Science, Vol. 25, PP. 2869~2877 (1980). 17.Mastral, F. J., Esperanza, E., Garcia, P. and Juste, M., “ Pyrolysis of high-density polyethylene in a fluidized bed reactor. Influence of the temperature and residence time, ” Journal of Analytical and Applied Pyrolysis, Vol. 63, PP. 1~15 (2002) 18.Shun, D., Bae, D. H., Cho, S. H. and Han, K. H., “ Bench scale fluidized bed pyrolysis of waste ABS resin, ” Korea Institute of Energy Research, PP. 305~343 (1995). 19.Suzuki, M. and Wilkie, C. A., “ The thermal degradation of acrylonitrile/butadiene/styrene terpolymer as study by TGA/FTIR, ” Polymer Degradation and Stability, Vol. 47, PP. 217~222 (1995a). 20.Suzuki, M. and Wilkie, C. A., “ The thermal degradation of acrylonitrile/butadiene/styrene terpolymer grafted with methacrylic acid, ” Polymer Degradation and Stability, Vol. 47, PP. 223~228 (1995b). 21.Wang, S., Hu, Y., Lei Song, Wang, Z., Chen, Z. and Fan, W., “ Preparation and thermal properties of ABS/montmorillonite nanocomposite, ” Polymer Degradation and Stability, Vol. 77, PP. 423~426 (2002). 22.Wang, S., Hu, Y., Wang, Z., Yong, T., Chen, Z. and Fan, W., “ Synthesis and characterization of polycarbonate/ABS/ montmorillonite nanocomposites, ” Polymer Degradation and Stability, Vol. 80, PP. 157~161 (2003). 23.Yang, M. H., “ The thermal degradation of acrylonitrile—butadiene — styrene terpolymer under various gas conditions, ” Polymer testing, Vol. 19, PP. 105~110 (2000). 24.楊思廉， “ 新材料塑膠 ”， 高立圖書公司 (1983)。 25.松金幹夫、田原省吾、家藤修士著，賴耿陽譯著， “ 聚碳酸脂樹脂PC原理與實用 ”， 復漢出版社 (1989)。 26.孫逸民，陳玉舜，趙敏勳，謝明學，劉興鑑， “ 儀器分析 ” (1997)。 27.劉玉芬， “ 氧氣對鋁箔包熱裂解之影響 ”， 國立台灣大學環境工程學研究所碩士論文 (1999)。 28.陳柏強， “ 桌上型電腦塑膠物質熱裂解資源回收之研究 ”， 大葉大學環境工程學研究所碩士論文 (2003)。