

## CHARACTERISTICS OF COPYROLYSIS POLYETHYLENE WITH CARBON DIOXIDE IN A HORIZONTAL DC PLASMA JET REACTOR

Y. Nie, A. S. Wu, Y. P. Sun, F. W. Yu, J. B. Ji

*College of Chemical Engineering and Materials Science,  
Zhejiang University of Technology, Hangzhou 310014, China*

Characteristics of copyrolysis polyethylene (PE) with greenhouse gas carbon dioxide (CO<sub>2</sub>) was investigated in a horizontal DC plasma jet reactor, for the aim to adjust the H<sub>2</sub>/CO molar ratio in the gaseous products in a wide range to further synthesize liquid fuel. For comparison, pyrolysis PE alone as well as pyrolysis CO<sub>2</sub> alone was also studied in light of CO yield. Results showed that: in case of plasma pyrolysis PE alone, product streams included combustible gas and solid carbon, and the main components of the gaseous products consisted of a large amount of H<sub>2</sub> achieved at 21.3 vol % and a small amount of low molecular hydrocarbon, CO was not determined in the gaseous products thanks to PE being hydrocarbon polymer. In terms of H<sub>2</sub> yield performance, the horizontal plasma jet reactor under development was superior to the downward mode. In case of plasma pyrolysis CO<sub>2</sub> alone, just a small amount of CO obtained from the decomposing reaction of CO<sub>2</sub>, and the CO concentration in the gaseous products was less than 5%. In case of plasma copyrolysis PE with CO<sub>2</sub>, a wide range of H<sub>2</sub>/CO molar ratio in the gaseous products can be obtained with varying the inlet CO<sub>2</sub> concentration, and the product of CO obtained mainly from the gasified reaction of carbon with CO<sub>2</sub>, in which carbon generated from plasma pyrolysis PE. In this paper, the H<sub>2</sub>/CO molar ratio was adjustable in the range of 1 to 12 from plasma copyrolysis PE with CO<sub>2</sub>. Thus, a significant synergy effect can be observed from copyrolysis PE with CO<sub>2</sub> in terms of the CO yields.

**Index Terms** —DC plasma jet, polyethylene, carbon dioxide, copyrolysis, H<sub>2</sub>/CO molar ratio

---

\* Work supported by Chinese Postdoctoral Science Fund (20060390453).