

## A Study on Treatment of PFCs Using Electron-beam

Jae-Yong Ryu·Seong-Ho Jang\*<sup>†</sup>·Han-Soo Kim\*\*

*Urban & Environmental Engineering, Kyungnam University*

*\*Department of Bio-Environment Energy, Pusan National University*

*\*\*Department of Food Science & Technology, Pusan National University*

*\*Corresponding author: Seong-Ho Jang (TEL:+82-55-350-5435, FAX:+82-55-350-5439,*

*E-mail : jangsh@pusan.ac.kr)*

### Abstract

Nitrogen trifluoride(NF<sub>3</sub>) and Sulfur hexafluoride (SF<sub>6</sub>) are usually used as novel etching and cleaning gases in semiconductor industry and electrical equipments. Recently, the many studies about PFCs decomposition have been performed due to high global warming potential(GWP). This study is to identify the effects of the hydrogen on the destruction and removal efficiency(DRE) of NF<sub>3</sub> and SF<sub>6</sub> when using the electron-beam. The experiment was conducted at a flow rate of 10 LPM with NF<sub>3</sub> and SF<sub>6</sub> of 1,000 ppm. Absorbed dose (electric current) was 1,028 kGy (5mA). The DREs of NF<sub>3</sub> and SF<sub>6</sub> gases increased about 54 % and 68 % respectively with hydrogen injection. By-products formed by NF<sub>3</sub> and SF<sub>6</sub> destruction were mainly HF and F<sub>2</sub> gases. In addition, the particulates were generated during the NF<sub>3</sub> and SF<sub>6</sub> destruction due to corrosion of reactor and sulfur particles, respectively.

**Table 1. Experimental methods and conditions**

Contents	Experimental conditions
Current (mA)	5 mA
Adsorbed dose(kGy)	1,028 kGy
SF <sub>6</sub> concentration (ppm)	N <sub>2</sub> : 10 L/min
	NF <sub>3</sub> : 1,000 ppm (10 mL/min)
	SF <sub>6</sub> : 1,000 ppm (10 mL/min)
Additive gas concentration (ppm)	NF <sub>3</sub> / H <sub>2</sub> : 1,500 ppm (15 mL/min)
	SF <sub>6</sub> / H <sub>2</sub> : 3,000 ppm (30 mL/min)
Reactor specification	Capacity : 685 × 200 × 200 mm (27.4 L)
	Reactor temperature : room temperature
Irradiation time (sec)	164.5 sec

**Keywords :** Electron-beam, PFCs, NF<sub>3</sub>, SF<sub>6</sub>, Semiconductor process

REFERENCES

- [1] Shoeib, M., Vlahos, P., Harner, T., Peters, A., Graustein, M.; Narayan, J., Survey of polyfluorinated chemical (PFCs) in the atmosphere over the northeast Atlantic Ocean, Atmospheric Environment, Vol. 44, pp. 2887-2893 (2010)
- [2] Choi, S., Hong, S. H., Lee, H. S., Watanabe, T., A comparative study of air nitrogen thermal plasmas for PFCs decomposition. Chemical Engineering Journal, Vol. 185-186, pp. 193-200 (2012)
- [3] Rahman, M. A., Sumona, G., Chetan, L., Joshipura, K. N., Krishnakumar, E., Electron ionization of  $\text{NF}_3$ . International Journal of Mass Spectrometry, Vol. 319-320, pp. 48-54 (2012)