

# Real-Time Plasma Process Monitoring with Impedance Analysis and Optical Emission Spectroscopy

Haegy Jang<sup>1</sup>, Daekyoung Kim<sup>1</sup>, Hoonbae Kim<sup>2</sup>, Sarum Han<sup>1</sup>, Heeyeop Chae<sup>1\*</sup>

<sup>1</sup>Department of Chemical Engineering, Sungkyunkwan University, Suwon, 440-746, Korea

<sup>2</sup>Department of Physics, Sungkyunkwan University, Suwon, 440-746, Korea

Plasma is widely used in various commercial etchers and chemical vapor deposition. Unfortunately, real-time plasma process monitoring is still difficult. Some methods of plasma diagnosis is improved, however, it is possible for real-time plasma diagnosis to use non-intrusive probe only. In this research, the object is to investigate the suitability of using impedance analysis and optical emission spectroscopy (OES) for real-time plasma process monitoring. It is assumed that plasma system is a equivalent circuit. Therefore, V-I probe is used for measuring impedance, which can be a new non-intrusive probe for plasma diagnosis. From impedance data, we tried to analyse physical properties of plasma. And OES, the other method of plasma diagnosis, is a typical non-intrusive probe for analyzing chemical properties. The amount of the OES data is typically large, so this poses a difficulty in extracting relevant information. To solve this problem, principal component analysis (PCA) can be used. For fundamental information, Ar plasma and O<sub>2</sub> plasma are used in this experiment. This method can be applied to real-time endpoint and fault detections.