

マイクロ波針状電極による大気圧放電

Microwave Atmospheric Discharge by Needle-Shaped Electrode.

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1. Introduction

Atmospheric pressure plasma processing is recently applied to various field like medical treatment, surface process, painting and agriculture. Without the need of vacuum system, it can provide fast processing time. The high density atmospheric pressure plasma produce variable active species like radicals, excited atoms and fast electrons which differ from normal gas characteristics. The high gas pressure causes particle mean free path to be short, so that the gas temperature increases and the plasma quickly achieves thermal equilibrium. To mitigate the heat load, dielectric barrier discharge, RF discharge and microwave discharge have been applied since they produce high electron temperature with low gas temperature. [1]

2. Experiment setup

Usually, atmospheric pressure plasma application for agricultural field utilizes all active species and the way of choosing particular ion species has not been developed yet. The final goal of the research is to develop a small type Ar atmospheric pressure plasma source by mobility separation for increasing efficiency of producing specific high density nitrogen and oxygen radicals.

Figure 1 shows a picture and schematic diagram of experimental system. The electrode is made of copper with sharp edged tungsten inserted on the top and 13.56MHz high frequency power supply is connected by a coaxial cable. The exit of the plasma source is constricted. The structure concentrates the electric field at the tungsten tip to efficiently produce. Plasma is ejected to outside from $\Phi 2\text{mm}$ hole on the pen's head.

To ignite plasma, tungsten wire is inserted temporarily to increase the electric field.

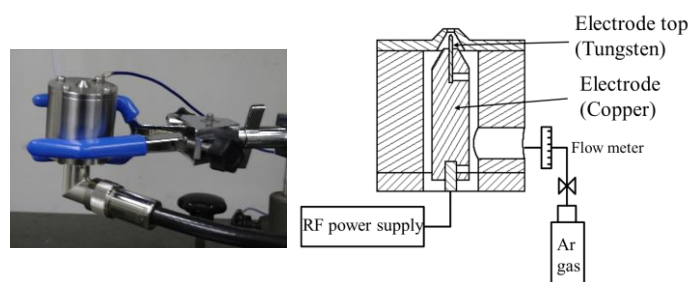


Fig.1 A Picture and schematic diagram of experimental system.

3. Result

Figure 2 shows the optical emission spectrum of plasma at 30pm Ar flow rate and 20W input power. In this spectrum, Ar ion species and nitrogen species were found. Nitrogen species seemed excited outside of the pen. A germination test is currently underway using the plasma pen.

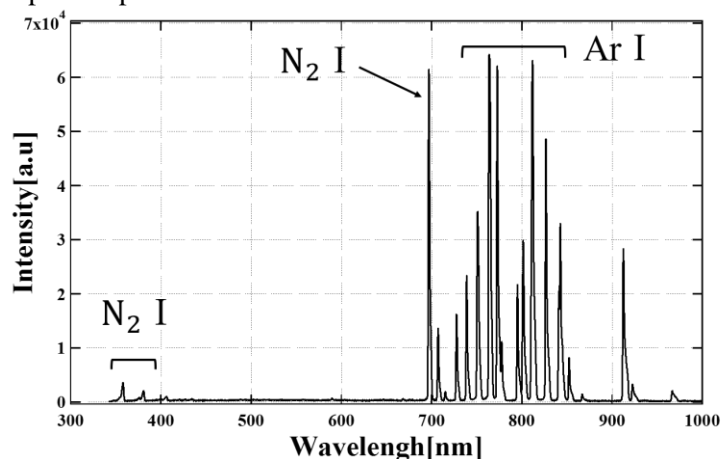


Fig.2 Spectrum of the atmospheric Ar plasma.

References

- [1] L. Bardos, H. Barankova/Thin Solid Films **518** 6705-6713(2010).