The Study of Non-Thermal Plasma by Optical Emission Spectroscopy with Nozzle-Plate Electrode

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Abstract:

The mechanism of electrohydrodynamic atomization (EHDA) has been studied and applied in industry, agriculture and other different area. Recently, the theory of plasma EHDA was put forward. With plasma, the efficiency of EHDA can be improved. However, in plasma EHDA process, the conclusion of plasma existing was drawn just by the phenomenon of corona discharge happened around the nozzle electrode5. The aim of this paper is to measure the non-thermal plasma by Optical Emission Spectroscopy (OES) to prove the plasma existing in this EHDA process and to drive the development of the technology of EHDA.

In the experiments, discharge nozzle electrode was supplied with positive DC high voltage or negative DC high voltage, respectively. The outside diameter (o. d.) of the nozzle electrode was 1.4mm.OES was performed with a grating monochromator. The signal was recorded onto an integrated two-dimensional thermoelectrically cooled charge-coupled device (CCD). The integrated time of CCD was chosen to be 10ms and the slit width was chosen to be 2500μm.

The fundamental I/V characteristics of the discharge nozzle supplied with negative high voltage or positive high voltage were studied, respectively. Plasma was measured by OES with different distances between nozzle and plate grounded with nozzle electrode supplied with high voltage. The absolute value of the high voltage is all 30kV.

The result shows that the corona discharge is more stable and the on-set corona voltage is lower when nozzle electrode supplied with negative DC high voltage. Plasma existing around the nozzle electrode was proved by OES. In addition, the intensity of the plasma's OES is affected by the distance of nozzle-plate. At the same value supplied high voltage, the smaller distance of nozzle-plate, the stronger intensity of plasma OES could be gotten.