STUDIES ON THE EFFECT OF NITROGEN IN XENON BASED DBD LAMP

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The existence of impurities could give a severe change or bring a negative or positive effect to the discharge and plasma characteristics. The common and typical impurities are those from H_2, N_2, CO_2, CH_4, etc. In this study in order to investigate the effect of impurities on discharge, they were purposely added with a few type of concentration percentage on xenon DBD (dielectric barrier discharge) lamp. It has been known that in electrical discharges a small amount of certain impurities could extend the dissociation of N_2, O_2, H_2[1]. In this paper the authors focused on the effect of nitrogen on xenon DBD discharge. Xenon was used instead of mercury as commonly used in lamp in order to develop environmentally-friendly light sources. Their discharge conditions, emission spectra and electrical characteristics were investigated.

The lamp pressure was set at 150 Torr and was discharged using high voltage pulse power supply (5 to 6 kV). The frequency was changed from 60 to 150 kHz and the discharge condition was observed. In parallel their emission spectra, input current and voltage were measured. The emission spectra covered from near UV to visible regions (300 to 800 nm). The internal electric parameters such as voltage across the dielectric and the gap, discharge current, excitation power and inputted energy were calculated.

The results of nitrogen contained lamp and pure xenon lamp were compared and discussed. Nitrogen in low concentration (0.1%) produced a more intense and stable plasma compared to the higher one (1%) where it tends to move when frequency is increased. There are no strong atomic lines that can be observed from the emission spectra. The waveform is similar with a xenon lamp but the continuum emissions at 350~450 nm and 500~550 nm that can be seen strongly in the xenon lamp are significantly weaker. In the case of higher concentrations, molecular spectra can be observed at near UV, and the continuum emissions at 620~700 nm and 720~780 nm. The near UV lines would be appropriate for phosphor excitation with less Stokes loses. The continuum emissions at wavelengths in the red color region may not be so helpful in obtaining a white colored light source, but they could be used to give a balance in color rendering if the blue and green spectrum can be produced using phosphor excitation. In terms of electrical parameters, its characteristics are almost same with xenon lamp except the value of gas gap voltage.

1. F. Kaufman and J. R. Kelso, “Catalytic Effects in the Dissociation of Oxygen in Microwave Discharges”, J. Chem. Phys., 32, 1960, pp.301-302