COMPARATIVE STUDY OF HOMOGENOUS DIELECTRIC BARRIER DISCHARGE IN ATMOSPHERIC INERT GASES *

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Dielectric barrier discharge (DBD) at atmospheric pressure are easily to get homogenous in helium and neon, but always un-uniform in other inert gases. In order to have a deep understanding of the mechanism of DBD in inert gases at atmospheric pressure, Comparative study of the discharge mode, evolution of the homogenous DBD and spectra in a parallel gap were carried out by means of electrical measurements, fast photography and time-resolved emission spectroscopy in different inert gases. It was found that homogenous DBD could be easily produced in 2~8mm gaps in helium and neon, and they were attributed to glow discharge. Compared to that in helium or neon, only a part of the 5mm-diameter electrode could be covered by homogenous DBD in 2mm argon gap. And a small increase of the applied voltage would convert the partly homogenous DBD into the pattern mode. If the gas gap was no less than 3 mm in argon, a bright filament would appear, and the current density could reach 7.5A/cm\textsuperscript{2} in the steamer channel. High-speed time-resolved photographs of the homogenous DBD in helium, neon and argon were taken using an Intensified-CCD camera with an exposure time of 10ns. Side-view photographs showed an evolution from Townsend discharge to glow discharge. The end-view photographs showed a radial development. The spectroscopic diagnosis showed that penning ionization was very important to obtain a homogenous DBD. N\textsubscript{2}\textsuperscript{+} first negative system (B\textsuperscript{+} \Sigma\textsubscript{g} \rightarrow X\Sigma\textsubscript{u}) was observed in helium, but not observed in the neon and argon. The emission spectral lines of N\textsubscript{2} second positive band system (C\textsuperscript{3}Π\textsubscript{u} \rightarrow B\textsuperscript{3}Π\textsubscript{g}) could be observed in neon and argon.

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