study of plasma parameters in cylndrial discharge

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A cylindrical coaxial DC glow discharge system has been designed forthe first time, in order to generate free plasma. The system consists of twocylindrical coaxial electrodes made of stainless steel. The outer electrode is 15cm length and 5 cm diameter, while the inner one is 10 cm length and 4 cmdiameter and it is a grid. The outer cylinder is the discharge vessel. The twocylindrical electrodes are isolated from each other by two glass discs. Heliumand nitrogen gases were used as working gases. A DC power supply of 1 kVand 100 mA was used to operate the discharge. The discharge vessel isevacuated by gas ballast rotary pump. Then the system was filled with heliumor nitrogen gases. The pressure is controlled by dynamic continuous flowthrough a needle valve.There are three main studies carried out in this work. In the first one theouter cylinder of the cylindrical coaxial discharge system (discharge vessel)was positively biased, while the inner grid cylinder was negatively biased.Helium was used as a working gas. The distance between the two coaxialcylindrical electrodes was fixed at 5 mm, it is comparable to the mean freepath of electrons. So, plasma was formed inside the inner grid cylinder. Thepositive ions will move toward the cathode and passing through the gridinward toward the center. A virtual anode was formed around the cylindricalcenter by the convergence of ions.I-V characteristic curves of the coaxial DC discharge showed that itoperates in a region similar to abnormal glow discharge. The breakdownvoltage decreased with increasing working gas pressure, which is similar tothe left hand side of Paschen’s curve. The radial distributions of plasmapotential and electric field was studied. Location of the virtual anode wasfound at 2 mm and 8 mm from the center, at discharge current 10 and 20 mArespectively.