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ELECTRICAL CHARACTERIZATION OF BARRIER DISCHARGES: LINKING FUNDAMENTALS AND APPLICATIONS

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Barrier Discharges (BDs) are frequently considered plasma sources in both industrial applications and fundamental research. They are a simple and robust method for generating distinctly non-thermal plasmas at atmospheric pressure [1]. Despite its wide application in industry (e.g. ozone generation, surface activation, air cleaning, plasma medicine, surface modification), there are still many open scientific questions. The diagnostic and simulation are challenging due to the transient character and small scale of this usually filamentary plasmas. Fast imaging and spectroscopy, laser diagnostics and surface charge/field measurements give insights in the fundamentals of these plasmas, such as the physics and chemistry of single microdischarges or the mechanisms for the generation of diffuse BDs. However, the electrical characterization is always a mandatory task as this allows the determination of the plasma power and the evaluation of plasma chemical performance [].

Although the principles were described as early as the 1940s by Manley; and further developed in the 1980s by Kogelschatz, Neiger and others, there is still a flurry of publication activity on this subject today. This is due to ever new discharge geometries driven by the manifold application options, the use of novel high voltage supplies and materials and a deeper view on the phenomena [3]. The lecture intends to give an introduction to the physics of BDs, which become more and more attractive for surface modification, e.g. plasma-assisted chemical vapour deposition at atmospheric pressure. Then, the principles of electrical characterization will be explained. The determination of operation parameters such as the discharge voltage and power is based on equivalent circuits (see figure 1), which will be briefly determined and discussed for some selected examples.

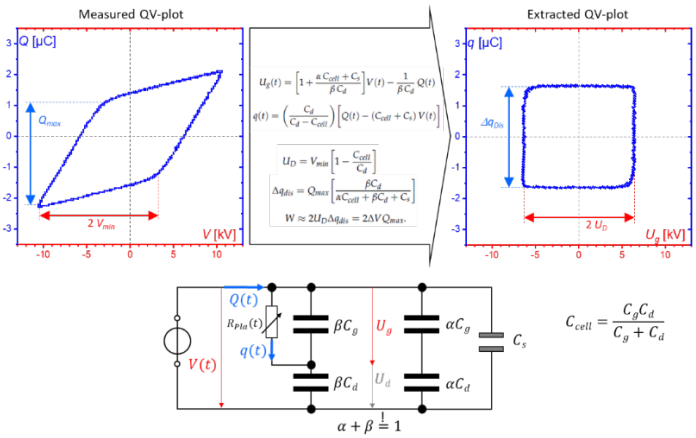

Figure 1: Typical charge-voltage plot of a BD (left). Based on the equivalent circuit shown in the bottom, distinct discharge parameters are determined (right).

[1] Becker, K.H.; Kogelschatz, U.; Schoenbach, K.H.; Barker, R.J. *Non-Equilibrium Air Plasmas at Atmospheric Pressure*; CRC Press: Boca Raton, FL, USA, 2005.
[2] Bruggeman, P.; Brandenburg, R. *J. Phys. D: Appl. Phys.* 2013, 46, 464001.
[3] Brandenburg, R. *Plas. Sources Sci. Technol.* 2017, 26, 053001.