

MEASUREMENT OF VOLTAGE AND CURRENT IN CONTINUOUS AND PULSED RF AND DC GLOW DISCHARGES

V. HOFFMANN¹, V. V. EFIMOVA¹, M. V. VORONOV², P. ŠMÍD³,

E. B. M. STEERS³, J. ECKERT¹

¹*Institut für Festkörper- und Werkstoffforschung Dresden,*

P.O.Box 270116, D-01171 Dresden

E-mail: V.Hoffmann@ifw-dresden.de

²*AQura GmbH, P.O.Box 915-d115, Rodenbacher Chaussee 4, D-63457 Hanau-Wolfgang*

E-mail: VoronovMV@mail.ru

³*London Metropolitan University, 166-220 Holloway Road, London, N7 8DB, UK*

E-mail: p.smid@londonmet.ac.uk

E-mail: e.steers@londonmet.ac.uk

Abstract. Electrical measurements are an important tool for the characterisation of glow discharges and have proved to be useful for a variety of needs in fundamental studies and as control parameter. Therefore, extensive hardware developments and studies of I-U characteristics in continuous and pulsed, dc and rf modes have been made (Wilken et al. 2007) and will be presented together with new results.

In continuous dc mode, the I-U curves are non-linear and may be characterised by a threshold voltage U_0 and saturation current I_{max} (both cathode material and pressure dependent). On the other hand P-U curves are to a large extent linear and very similar in the continuous rf mode (Hoffmann et al. 1998). The ionic part of time resolved I-U curves of rf discharges however shows almost a linear behaviour and the capacitive component is small. No saturation current exists. This led to the assumption that gas heating is responsible for the non-linearity between U and I in continuous dc discharges. Consistent with this assumption, a dependence of the U-I curves of *pulsed* discharges on the duty cycle was found. The comparison of the curves with those at low duty cycle (cold) led to a rough estimation of the gas temperature.

Owing to the large changes of current in a very short time, the measurement of the electronic part of the U-I curve in rf mode is far more difficult. If conducting samples are analysed, this electronic part contains extra information. For *pulsed* rf discharges the hysteresis of electronic part increased with decreasing duty cycle (lower gas temperature). In a study of the effect of the addition of small amounts of H₂ to the Ar discharge gas similar changes in the electronic part of the U-I curve were observed whereas the ionic part was identical. Further investigation and cooperation with modelling groups is needed and planned to explain these results.

References

- Hoffmann, V., Praessler, F., Wetzig, K.: 1998, in: C. Vogt, R. Wennrich, and G. Werner (Editors), Colloquium Analytische Atomspektroskopie, Universität Leipzig, 29-39.
 Wilken, L., Hoffmann, V. and Wetzig, K.: 2007, *Spectrochim. Acta Part B*, **62**, 1085.