

IMPURITY INFLUENCE ON THE V-I CHARACTERISTIC OF GLOW DISCHARGE*

P.A. BOKHAN¹, G.V. SHEVCHENKO^{1,2}, P.P. GUGIN¹, V.A. KIM¹, D.E. ZAKREVSKY^{1,2}

¹ Rzhanov Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia

² Novosibirsk State Technical University, Novosibirsk, Russia

High-voltage glow discharges in helium and other noble gases are find a variety of applications in various fields of science and technology. It is possible to allocate two directions on which the most intensive researches are carried out: generation of electron beams keV – range of energies and commutation of high-voltage pulses with subnanosecond rise front [1,2]. The transition to high voltages made it possible to obtain results previously unknown in the study of low-voltage discharges. One of the most unusual is the detection of S – shaped volt-ampere characteristics (V–I characteristics). For the first time they were registered as early as 1965 in the work [3], but up to 2002 [4] they were not obtained. In a series of subsequent papers [5,6 et al] it was shown that the S – shaped V–I characteristics are registered only in high frequency gases, both in the conventional glow discharge and in its special form of "open discharge".

In the present work, the influence of impurities on the V–I characteristic was investigated under different conditions from the [5,6] works. The discharge between a flat molybdenum cathode with an active area of 2cm² and a copper anode in the form of a Faraday cylinder was used. Simultaneously with the measurement of the V–I characteristic, the emission spectrum of the plasma in the interelectrode gap was recorded. Fig.1 shows the radiation spectrum from the helium discharge for 3 cases with the impurity content of 10⁻³, 10⁻⁴ and less than 10⁻⁵ Torr. Fig.2 shows the corresponding V–I characteristics. It can be seen that the more polluted the helium, the higher the current, and the V–I characteristic becomes more rapid-growing. These changes are attributed to the transition of emission under the influence of energetic impurity ions formed by the recharge of helium ions on impurities and the acceleration of impurity ions in the region of which the potential drops to an energy comparable to the value of eU, where U is the applied voltage.

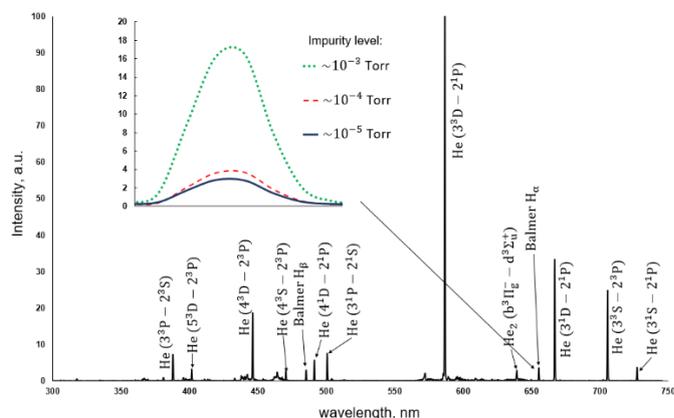


Fig. 1 Plasma spectrum at different impurity content

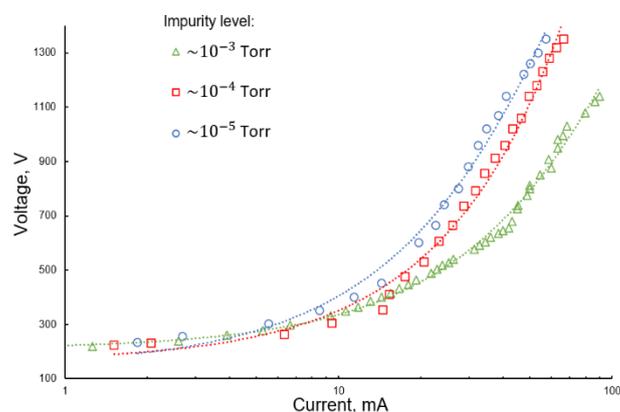


Fig. 2 V-I characteristics of the glow discharge at different impurity content

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