

## High-current pulsed planar magnetron discharge with electron injection

*M. V. Shandrikov, A. A. Cherkasov and E. M. Oks*

Institute of High Current Electronics, Russian Academy of Sciences  
2/3 Akademicheskoy Ave., Tomsk, 634055, Russia  
E-mail: shandrikov@opee.hcei.tsc.ru

*Received 26.04.2023; revised 30.05.2023; accepted 27.06.2023*

***The results of experimental studies of a discharge system based on a pulsed (200÷400  $\mu$ s, 5÷25 pps) high-current (5÷30 A) planar magnetron discharge with a target diameter of 125 mm and additional electron injection from a vacuum arc discharge are presented. The injection of electrons into the magnetron discharge is carried out from the back of the sputtered target through the central aperture, which provides additional acceleration of the injected electrons in a cathode layer of the magnetron discharge and an increase in the energy efficiency of the discharge system. The mass-to-charge ion composition of the generated plasma has been studied in a range of operating pressure up to an extremely low level of 0,2 mTorr. The conditions for achieve a high fraction of target material ions in magnetron plasma are defined, including in the range of low operating pressure range, where the typical magnetron discharge is characterized by an increase of a working gas ions fraction, transition into a low-current form, or is not realized at all.***

*Keywords:* magnetron discharge, electron injection, ion mass-to-charge composition.

DOI: 10.51368/1996-0948-2023-5-41-45

### REFERENCES

1. Thornton J. A., J. Vac. Sci. & Techn. **11**, 666 (1974).
2. Nikulin Yu. V., Dzhumaliev A. S. and Filimonov Yu. A., Technical Physics **61** (5), 141 (2016).
3. Li T., Han J., Xing Y., et al., Micro & Nano Letters **14** (2), 146 (2018).
4. Helmer J. C. and Wickersham C. E., J. Vac. Sci. & Techn. **A4**, 408 (1986).
5. Cuomo J. J., Kaufman H. R. and Rossnagel S. M., Patent № 4588490 (U.S.). 1986.
6. Gavrilov N. V., Kamenetskikh A. S., et al., J. Phys.: Conf. Ser. **652**, 012024 (2015).
7. Shandrikov M. V., Cherkasov A. A. and Oks E. M., Vacuum **200**, 111056 (2022).