Optimization of a low pressure sputter-ion sensor

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The article discusses theoretical and experimental studies of low-pressure sputter-ion sensors in nitrogen-oxygen plasma. Sensor is an electrode system in the form of a cylindrical capacitor with crossed electric and magnetic fields. The magnetic field allows for maintaining the sustainable development of the electric discharge. There suggested the system of plasma chemical equations upon which expression for the dependence of the current from the applied voltage and the sensor pressure was obtained. The agreement of the results of theoretical and experimental studies is satisfactory. Based on these results recommendations for optimizing the sensor are provided - the sensor size is decreased and the accuracy of the pressure measurements is increased.

Keywords: *sensor, pressure, discharge, electric field, magnetic field, plasma chemical reactions, current, volt-ampere characteristic.*

REFERENCES

[1] Jamal R.K., Aadim K.A., Al-zaidi Q.G., Taaban I.N. Hydrogen Gas Sensors Based on Electrostatically Spray Deposited Nickel Oxide Thin Film Structures. *Photonic Sensors*, June 2015, pp. 235–240. DOI: 10.1007/s13320-015-0253-0

[2] López-Herrera J.M., Barrero A., Boucard A. An Experimental Study of the Electrospraying of Water in Air at Atmospheric Pressure. *Journal of the American Society for Mass Spectrometry*, March 2004.

[3] Zhu X.F., Thiam S., Valle B.C., Warner I.M. A Colloidal Graphite-Coated Emitter for Sheathless Capillary Electrophoresis. Nanoelectrospray Ionization Mass Spectrometry. *Anal. Chem.* 2002**,** 74 (20), pp. 5405–5409.

[4] Grosu F.P., Bologa A.M., Bologa M.K., Motorin O.V. *Surface Engineering and Applied Electrochemistry*, 2015, vol. 51, no. 5, pp. 456–461.

[5] Penchko E.A., Kostin L.A. *Ionizatsionnyy vakuummetr* [The Ionization Vacuum Gauge]. Certificate of Authorship, SU, no. 1472777. Priority on August 11, 1987, published April 15, 1989, Bulletin no. 14.

[6] Zhakin A.I., Lutsenko A.A. *Surface Engineering and Applied Electrochemistry*, 2012, vol. 48, no. 2, pp. 156–160.

[7] Zhakin A.I., Bogomazov R.Yu. *Surface Engineering and Applied Electrochemistry*, 2012, vol. 48, no. 3, pp. 264–267.

[8] Mnatsakanyan A.Kh., Naydis G.V. Protsessy obrazovaniya i gibeli chastits v azotno-kislorodnoy plazme [The Processes of Formation and Destruction of Particles in the Nitrogen-Oxygen Plasma]. *Khimiya plazmy. Sbornik statey* [Plasma Chemistry. Collected articles]. Smirnov B.M., ed. Vol. 14. Moscow, Energoizdat Publ., 1987, 296 p.

[9] Mnatsakanyan A.Kh., Naydis G.V., Solozubov Yu.M. *Teplofizika vysokikh temperatur —Thermophysics of High Temperatures*, vol. 24, no. 6, 1986, pp. 1060–1066.

[10] McEwan M.J., Phillips L.F. *Chemistry of the Atmosphere*. Edward Arnold Ltd., London, 1975 [In Russ.: Mak-Iven M., Filips Kh. Khimiya atmosfery. Moscow, Mir Publ., 1978].

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