PACS: 41.20.Jb; 4.40.+a

Formation of metal-dielectric structures with nanometer conductive films and study of their heating under the influence of microwave fields

E. V. Grigoriev, S. P. Arsenichev, A. V. Starosek, I. Sh. Fitaev, and N. A. Boldyrev

V. I. Vernadsky Crimean Federal University
4 Prospekt Vernadskogo, Simferopol, Republic of Crimea, 295007, Russia
E-mail: starosekav@cfuv.ru

Received June 27, 2022

The paper presents the results of experimental studies and analysis of the heating dynamics of metal-dielectric structures with aluminum conducting films deposited by magnetron sputtering on glass substrates exposed to powerful microwave fields. The results of modeling the mechanism of formation of inhomogeneous metallization structure and the appearance of conductivity in growing film confirmed the observed temperature extremum. That extremum is due to a maximum absorption of electromagnetic waves at approximate thickness of 5 nm, which is associated with the structure of the growing film and its corresponding mechanism of conductivity.

Keywords: metal-dielectric structure, nanometer conducting films, microwave, electromagnetic heating.

DOI: 10.51368/1996-0948-2022-4-64-69

REFERENCES

1. G. Nimtz and Uwe Panten, Ann. Phys. (Berlin) **19** (1-2), 53 (2010).
2. H. Bosman, Y. Y. Lau, and R. M. Gilgenbach, Appl. Phys. Lett. **82**, 1353 (2003).
3. S. Li, Sh. Anw , W. Lu, Zhi Hong Hang, Bo Hou, M. Shen, and Chin-Hua Wang, AIP ADVANCES **4** (1), 017130 (2014)
4. V. L. Soethe, E. L. Nohara, L. C. Fontana, and M. C. Rezende, J. Aerosp. Technol. Manag. **3** (3), 279 (2012).
5. S. . Arsenichev, E. V. Grigoriev, S. A. Zuev, V. V. Starostenko, E. P. Taran, and I. Sh. Fitaev, Electromagnetic waves and electronic systems **22** (2), 48 (2017).
6. V. V. arostenko, A. S. Mazinov, I. Sh. Fitaev, E. P. Taran, and V. B. Orlenson, Applied Physics, No. 4, 60 (2019) [in Russian].
7. I. V. Lebedev, *Technique and microwave devices*. V. 1. (Higher school, Moscow, 1970).
8. V. Nikolsky and T. I. Nikolskaya, *Electrodynamics and radio wave propagation* (Nauka, Moscow, 1989).
9. . Sh. Fitaev, V. V. Starostenko, A. S. Mazinov, M. M. Padalinsky, and S. P. Arsenichev, Microwave and Telecommunication Technology **3**, 340 (2021).
10. . S. Mazinov, A. S. Tyutyunik, V. S. Gurchenko, I. Sh. Fitaev, and V. M. Vasilchenko, in *2020 International Conference on Actual Problems of Electron Devices Engineering (APEDE)*, (Saratov, 2020), p. 47–50.
11. N. Ab ellaoui, A. Pereira, M. Novotny, J. Bulir, P. Fitl, J. Lancok, B. Moine, and A. Pillonnet, Applied Surface Science **418**, 517 (2017).
12. I. V. Antonets, L. N. Kotov, E. A. Golubev, V. G. Shavrov, and V. I. Shcheglov, Journal of Radio Electronics **5**, (2018). DOI 10.30898/1684-1719.2018.5.2
13. Hövel, B. Gompf, and M. Dressel, Physical Review B **81** (3), 035402 (2010).
14. V. G. Andreev, V. A. Vdovin, S. M. Pronin, and I. A. Khorin, Journal of Radio Electronics, No. 11 (2017).
15. V. . Starostenko, S. P. Arsenichev, E. V. Grigorjev, I. Sh. Fitaev, and A. S. Mazinov, in *Radiation and Scattering of Electromagnetic Waves*, (Divnomorskoye, 2021), p. 223–226.