Analytical Review of the Reports Presented at the 15th International Conference on Films and Coatings (ICFC2021)

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Abstract. In this preface main trends in the development of films and coatings technology presented at the 15th International Conference on Films and Coatings (ICFC2021) that was held on 18–20 May 2021 in Saint Petersburg, Russia are discussed.

The Proceedings are based on the materials of the reports submitted to the 15th International Conference “Films and Coatings – 2021” (figure 1). The materials of the reports present new results of theoretical and experimental research in the field of condensed matter physics and mechanics, the formation of films and coatings by plasma and related methods, obtained over the past two years since the previous Conference.

Special attention is paid to the study of the properties of coatings and methods of their research, new coating materials and new areas of their use, nanomaterials and nanotechnologies, plasma physics and mechanics, the interaction of plasma with the surface of a solid body, the development of modern equipment and technological processes, as well as issues related to control, automation and robotics. The ways of development of new methods of obtaining films and coatings are outlined. The Conference was held both with the full-time participation of speakers and in an online format.

Figure 1. Some photos from the Conference.
The following reports aroused great interest.

In the report of S A Kukushkin, the main idea and theory of a new method for the synthesis of SiC epitaxial films on Si are presented. The developed method consists in replacing part of the Si atoms with C directly inside the silicon matrix. The method allows to solve one of the main problems of heteroepitaxy, namely, to synthesize low-defect epitaxial films with a large difference between the lattice parameters of the film and the substrate. Numerous experimental results on the growth of SiC epitaxial layers on Si and their structural, optical, electrophysical, and magnetic properties are presented.

The report of V G Kuznetsov is devoted to the development of a new technology for applying an anti-emission pyrocarbon coating by plasma-chemical gas-phase deposition to the grid electrodes of high-power electrovacuum devices. For the first time, the plasma of a vacuum-arc discharge from a graphite cathode is simultaneously used to heat the grid electrodes, clean them from surface contamination, and decompose the reaction gas into active radicals. This made it possible to reduce the temperature of pyrolytic carbon synthesis, increase the adhesion of coatings on grid electrodes, and increase the rate of pyrocarbon deposition to 3 μm/s. Experimental studies have shown that the satisfactory structure of the coatings and the adhesion of the coatings to the grid electrodes is provided at the grid temperature in the range from 550 to 1300 °C.

In the report of V P Sergeev, the influence of transparent nanocomposite coatings based on the Al-Si-N system deposited on the surface of quartz glasses by pulsed magnetron sputtering on their ultimate strength at centrosymmetric bending is investigated in relation to increasing the resistance of optical elements of spacecraft and stations. The coatings have a high hardness of 30.2 GPa and an adhesion to glass of 16.4 N. Double-sided coating on glass discs increases the tensile strength by more than ~1.5 times compared to single-sided coating by ~1.3 times.

A number of reports are devoted to a promising area of research related to the development of a vacuum-arc plasma-assisted coating deposition method. It is shown that it is possible to increase the concentration of nitrogen in the coating by increasing the proportion of nitrogen ions in the gas-metal plasma using a gas plasma source with incandescent and hollow cathodes. By increasing the discharge current of the gas plasma source, it is possible to achieve the complete disappearance of the metal phase and increase the proportion of the MoN phase to 67 wt. %. At the same time, there is an increase in the hardness of MoN coatings by 1.3 times, and an increase in wear resistance by 2.4 times compared to the parameters of coatings deposited in modes without plasma assistance.

The practical use of the obtained results contributes to the creation of mathematical programs for the calculation of technological processes for the formation of films and coatings by ion-plasma and related methods. These results allow to identify the factors that determine the structure and phase composition of the formed coating, as well as to determine the optimal conditions for their deposition.

Much attention was paid at the Conference to the young scientists section, where promising young scientists presented interesting reports that deserve attention.

The works are of interest to specialists engaged in scientific research, the development of technological processes related to the production of films and coatings, issues of hardening, restoration of parts and corrosion protection, the study of the properties of coatings and other applications.
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