Main Results of the 27th International Conference on Vacuum Technique and Technology (VTT2020)

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Abstract. In this preface the main results of the 27th International Conference on Vacuum Technique and Technology (VTT2020) that was held on 27–29 October 2020 in Saint Petersburg, Russia are discussed.

From 27 to 29 October 2020, the 27th International Conference on Vacuum Technique and Technology was held in the virtual form at the Saint Petersburg Electrotechnical University “LETI”. The Conference was organized by the Ministry of Science and Higher Education of the Russian Federation, Saint Petersburg Electrotechnical University “LETI” named after V I Ulyanov (Lenin), All-Russian Research Institute of Metrology named after D I Mendeleev, Institute of Problems of Mechanical Engineering of the Russian Academy of Sciences, Russian Scientific and Technical Vacuum Society named after Academician S A Vekshinskiy, Peter the Great Saint Petersburg Polytechnic University, Euro-Asian Cooperation of National Metrology Institutes (COOMET), National Metrology Institute (TUBITAK UME, Turkey).

The Conference was devoted to the latest achievements in vacuum physics, vacuum achievement and pressure measurement techniques, problems of tightness, surface treatment methods, and the creation of promising materials and coatings. Special attention was paid to the use of vacuum technologies in scientific research, in the nuclear and space industries, metallurgy and extractive industries. Issues of education, advanced training and training of highly qualified specialists were also discussed.

During the first plenary session, under the chairmanship of Professor of the Department of Physical Electronics and Technology of Saint Petersburg Electrotechnical University Viktor Ivanovich Shapovalov, Director of the Department of Science of Saint Petersburg Electrotechnical University Sergey Anatolyevich Tarasov made a welcoming speech.

"It is difficult to overestimate the importance of vacuum technology for the electronics industry. Vacuum technology is included in the development strategy of the industrial complex until 2030. Our conference will focus on vacuum physics, vacuum achievement techniques, pressure measurement and other important issues that determine the current state of high technology."

– Director of the Department of Science of Saint Petersburg Electrotechnical University
Sergey Anatolyevich Tarasov

In his video message to the Conference participants, cosmonaut Alexander Alexandrovich Skvortsov said that the flag of the Russian Scientific and Technical Vacuum Society is on board of the International Space Station (figure 1). "The Conference on Vacuum Technique and Technology is
dedicated to all Russian scientists and specialists who have worked in the field of vacuum and cryogenic technology in different years,” added Alexander Alexandrovich. His colleague Oleg Yurievich Skripochka wished success in all activities, including the expansion of mutually beneficial cooperation with organizations of the rocket and space industry.

Figure 1. Greetings from the International Space Station.

The president of the Russian Scientific and Technical Vacuum Society, Sergey Borisovich Nesterov read an excerpt from a document written by Academician S A Vekshinskiy: “The very fact of the birth of the electrovacuum industry led to the creation and study of a new technique – high vacuum technology”.

“Our scientists have made a great contribution to the development of the vacuum industry. The Global energy revolution is now one step closer. In France, the construction of a building for ITER – the World’s first new-generation thermonuclear reactor – has been completed. Now there is a new stage – the assembly of the installation itself. Russia is taking an active part in this international project.”

– President of the Russian Scientific and Technical Vacuum Society
Sergey Borisovich Nesterov

In the plenary report, the Head of the Department of Electronic Instruments and Devices of Saint Petersburg Electrotechnical University Nikolay Nikolaevich Potrakhov touched upon the key issues of creating domestic X-ray tubes of a new type and radiation sources based on them (figure 2). Scientists of the Department of Electronic Instruments and Devices – one of the World leaders in the field of microfocus radiography – have developed a unique digital portable X-ray diagnostic complex for neonatology, which allows accurate diagnosis of newborns in non-specialized conditions in the shortest possible time and with a minimum dose of radiation.

N N Potrakhov also spoke about the prototype of a unique device for non-invasive cancer treatment, which in February 2020 was presented to the Head of the Federal Medical and Biological Agency of Russia Veronika Igorevna Skvortsova.

“Oncological diseases are treated by external radiation of the tumor. The source is located far from it, which makes it difficult to hit the target. We have developed an economical, safe and compact device, thanks to which the doctor will be able to accurately "shoot" a cancer from a short distance. The main element of the device is the source of X-ray radiation – a small X-ray tube that is delivered to the cancer through an incision made in the patient’s body. The ability to bring the beam source as close as possible to the source of the disease will be a key advantage of the domestic device in comparison with foreign analogues.”

– Head of the Department of Electronic Instruments and Devices
Nikolay Nikolaevich Potrakhov
Figure 2. Virtual discussion during the Conference.

Alexander Evgenievich Zarvin, Head of the Department of Applied Physics at Novosibirsk State University, spoke about the simulation of supersonic jets of spacecraft in a highly rarefied environment on small-sized laboratory installations. Alexey Vasilievich Burmistrov, Vice-Rector for academic affairs of Kazan National Research Technological University presented the results of a study on improving the efficiency of the working process of contactless vacuum pumps. Deputy General Director for Science of the Research Institute of Precision Engineering Vadim Vasilievich Odinokov made a report on the topic “Vacuum-plasma equipment for the production of ECB on plates with a diameter of 200 mm with a technology level of 180-65 nm”. Vladimir Anatolievich Polyanskiy, Director of the Institute of Problems of Mechanical Engineering of the Russian Academy of Sciences spoke about the use of hydrogen diagnostics for leak detection and technological control of cracking.

Plenary reports of the Chairman of the Technical Committee of the Euro-Asian Cooperation of National Metrological Institutes – COOMET Irina Alexandrovna Kolozinskaya (Ukraine) and Alexander Alexandrovich Chernyshenko, Head of the Laboratory at All-Russian Research Institute of Metrology named after D I Mendeleev (Russia), were dedicated to a historic event for the global economy. In November 2018, within the framework of the XXVI General Conference on Weights and Measures in Versailles (France), the International Standard of the Kilogram in the form of a cylinder made of platinum-iridium alloy, which was stored in the International Bureau of Weights and Measures, was retired. In the new version, the mass standard is defined in terms of the Planck
constant. In total, four of the seven SI base units were redefined. The decision of the Conference came into force on 20 May 2019.

"Changing the measurement mechanism will have a huge impact on the World. It will have an impact on accelerating innovation and reducing the cost of technological development. In this way, the science of measurement will adapt to the needs of future generations."

– Head of the Laboratory at All-Russian Research Institute of Metrology named after D I Mendeleev

Alexander Alexandrovich Chernyshenko

During the sectional sessions, more than 100 specialists from Russia, Turkey and Ukraine presented 50 oral and poster presentations. The works were devoted to the latest achievements in vacuum physics, pressure measurement techniques, problems of tightness and the creation of promising materials, surface treatment methods, and the application of vacuum technologies in various industries.

During the Conference, scientists came to the conclusion about the need to expand research in the field of metrology of the total and partial pressures in the high and ultrahigh vacuum; leakage control; modeling of ground-based laboratory plants processes in vacuum in the development of rocket and space technology; low-temperature plasma for creation of new advanced materials.

When discussing the draft decision of the Conference, the scientists came to the conclusion that a clearly formulated strategy is necessary for progress in vacuum technology. The Conference participants agreed that in the field of production, it is necessary to ensure the creation of a size range of oil-free pre-vacuum pumps, wide-range vacuum meters and partial pressure analyzers. It is also necessary to develop such modern areas as analytical equipment, universal wide-range sensors, automation of pressure monitoring and process control.

As a result of the Conference, it was decided to create a register of organizations of the North-Western Federal District of Russia that develop, produce and use vacuum equipment in production.

"The country must maintain its position as an industrially developed power. One of the mandatory conditions for achieving technological sovereignty of the Russian Federation is the development of high-tech industries. It is these industries that include vacuum technology and vacuum technology."

– Professor of the Department of Physical Electronics and Technology of Saint Petersburg Electrotechnical University Viktor Ivanovich Shapovalov
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