

The conquest of the Arctic continues: the results of the first year of work on the EFREA international project are summed up

The results of the first year of the EFREA Project were discussed at a recent video conference, a meeting of the Steering Committee of the KS1054 project implemented under the Southeast Finland - Russia 2014-2020 Cross-Border Cooperation Program. During the meeting the consortium members, representatives of Lappeenranta - Lahti University of Technology (LUT; Finland), Peter the Great St. Petersburg Polytechnic University and NRC Kurchatov Institute - CRISM Prometheus discussed the results of the first year of the project and established the vector of the work plan for the next period.



The Energy-efficient systems based on renewable energy for Arctic conditions (EFREA) project differs from other projects by its integrated multidisciplinary approach. In order to create a reliable structure that will work consistently in the harsh Arctic conditions, it is necessary not only to solve the engineering problem of its creation, but also to predict the conditions under which the structure will work. It means that all climatic factors must be taken into account, the right materials with the right characteristics chosen, the whole cycle of work thought over,

starting from installation and welding of modular construction in severe weather conditions. That's why specialists in a wide range of fields [work together within the frame of this project](#). There are two scientific groups in SPbPU: the Wind and Welding. They comprise leading specialists from two different divisions of Polytechnic University: REC "Renewable Energy and Installations Based on It" (ICE) and the Higher School of Physics and Materials Technology (IEM&T).

During the first year of the project, the participants conducted research related to the formation of a database of natural and climatic information in the Arctic. They identified the values of extreme characteristics of temperature, wind flow, as well as parameters that affect icing. All this is necessary for the development of layers of a special information system when designing equipment for the Arctic zone.

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Исследование эффективности газовой защиты при воздействии возмущающих факторов

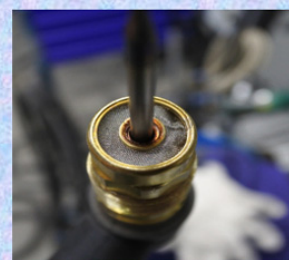
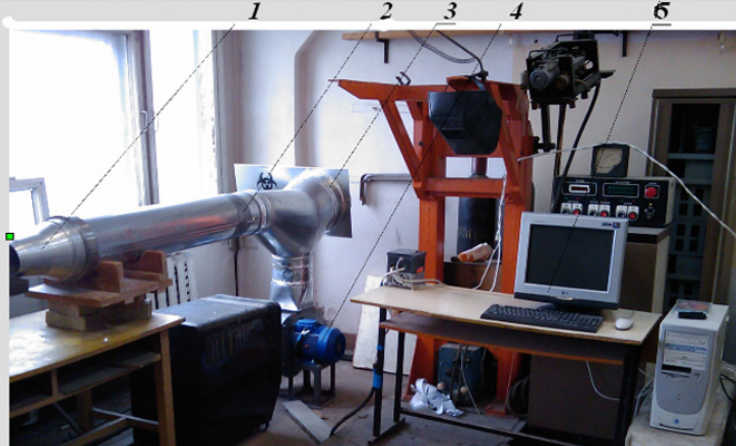
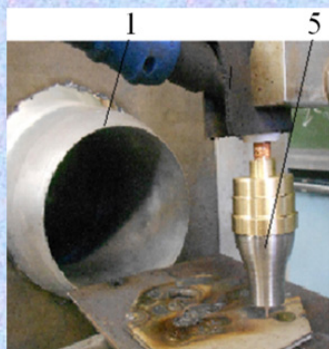


Схема методики:

- 1 - сопло аэродинамической трубы;
- 2 - дроссельная заслонка;
- 3 - шиберная задвижка; 4 - корпус вентилятора;
- 5 - горелка с конфузным соплом и пакетом сеток;
- 6 - компьютер

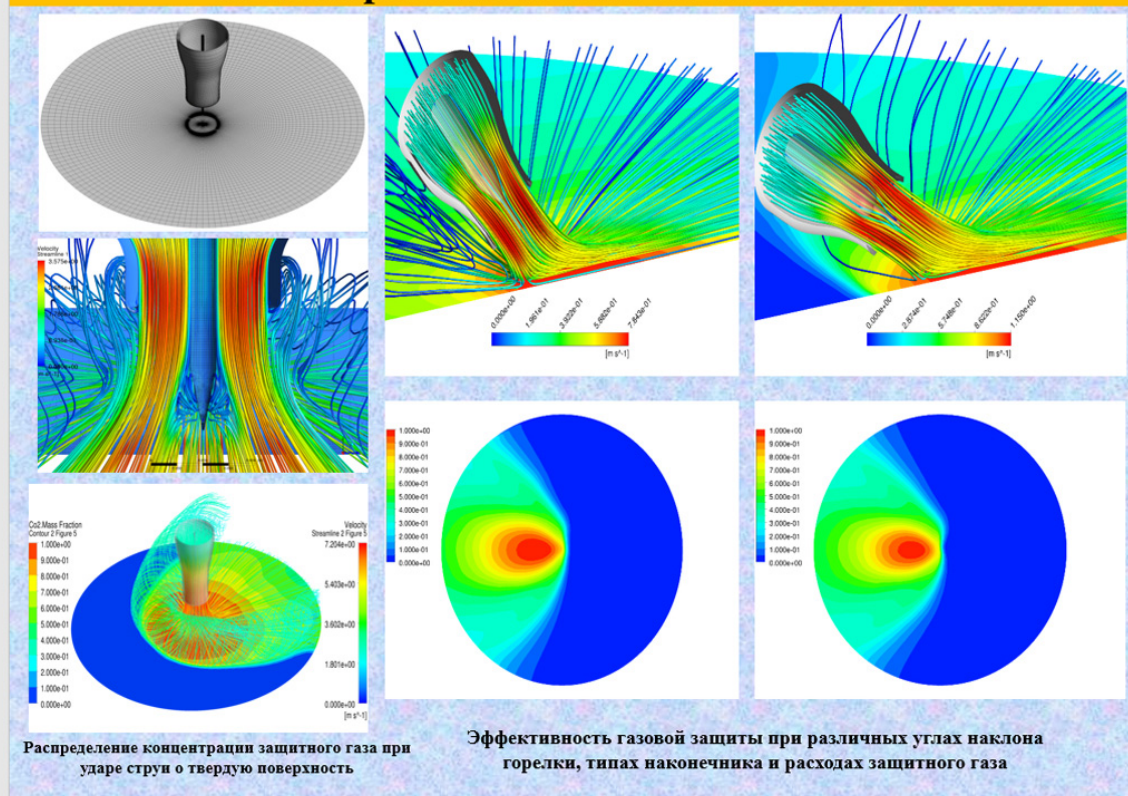
"Young guys are also involved in the project: three Master's degree theses connected with substantiation of parameters of power complexes with wind power plants adapted to the northern conditions and with capacity up to 100 kW to ensure reliable power supply have already been completed. The peculiarity of one

of the works is the substantiation of parameters and calculation of structural design of steel modular foundation made of cold-resistant steel for a wind power plant. The work contains results of calculation of the stress-strain state of the foundation and technology elements and combining the elements into a single structure”, - said Victor ELISTRATOV, scientific director of the Wind Group, Professor at the Higher School of Hydrotechnical and Power Engineering Construction of the ICE.

The development of complex structures requires in-depth analysis and accurate calculations, and modern engineering is not possible without modeling basic processes. The next- year work of the Welding Scientific Group will be focused on mathematical modeling of mechanical strength and welding metallurgy of Arctic structures. To carry out work on the EFREA Project, the Higher School of Material Physics and Technology has created an educational and scientific laboratory for computer simulation of welding and chemical-metallurgical processes, in which Master’s degree and postgraduate students under the guidance of Professors Victor KARKHIN and Sergei PARSHIN solve problems of welding thermodynamics and metallurgy. The scientific group works on the problem of strength mechanics modeling of welded structures in close contact with scientists of the LUT’s welding laboratory and the laboratory of steel structures of under the guidance of Professor Timo Björk.

“In our laboratory, complex end-to-end modeling is based on the application of Ansys Mechanical and Thermo-Calc programs and allows solving mechanical, thermo-modeling, metallurgical and diffusion problems when creating arctic structures made of complex alloyed steels and alloys, from the choice of materials to the finished structure,” explained Sergey PARSHIN, scientific director of the Welding Group, professor at the Higher School of Material Physics and Technology.

Моделирование потока защитного газа



Participation in the EFREA Project allowed scientists from SPbPU come up with a number of publications and scientific monographs, including in co-authorship with foreign colleagues: Professor Victor KARKHIN prepared the monograph Thermal Processes in Welding in 2019, and Professor Sergey PARSHIN prepared the monograph Metallurgy of Welding in 2020. Two articles, i.e., The Method of Numerical Modeling of the Level Ice Impact on the Sloping Profile Structures and Conceptual Analysis of the Power of Offshore Wind Plants Designed to Operate in Arctic Conditions were adopted for presentation at the ISOPE-2020 International Conference. They were prepared by a team of authors under the guidance of Professors Victor ELISTRATOV and Alexander BOLSHEV.

The Steering Committee at the meeting highly appreciated the results of the first year of the project and outlined the research plan for the coming year. Some changes in the consortium's activities related to the pandemic situation will concern scientific conferences and workshops: they are likely to be held online. In particular, participants agreed to hold the next international online conference as part of the project in early October 2020. Peter the Great Polytechnic University will be the main organizer of this event.

Prepared by the SPbPU International Office

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