# Scientists from SPbPU conducted an experiment at the Shanghai Synchrotron Radiation Center of the Chinese Academy of Sciences

Scientists from the Higher School of Engineering and Physics of SPbPU conducted an experiment with antisegnetoelectric films at the Shanghai Synchrotron Radiation Center of the Chinese Academy of Sciences. The experiment was carried out within the framework of a project supported by the Russian Science Foundation (RSF) and was made possible thanks to the cooperation of a team of SPbPU researchers with colleagues from the Harbin Institute of Technology.

The Shanghai Synchrotron Radiation Center is a third-generation X-ray source and is a very significant tool for world science. Today, it is the largest scientific platform for research and technology development in China. More than one hundred scientists and engineers from universities, institutes and industrial enterprises in China and other countries conduct experiments and development activities on a daily basis.

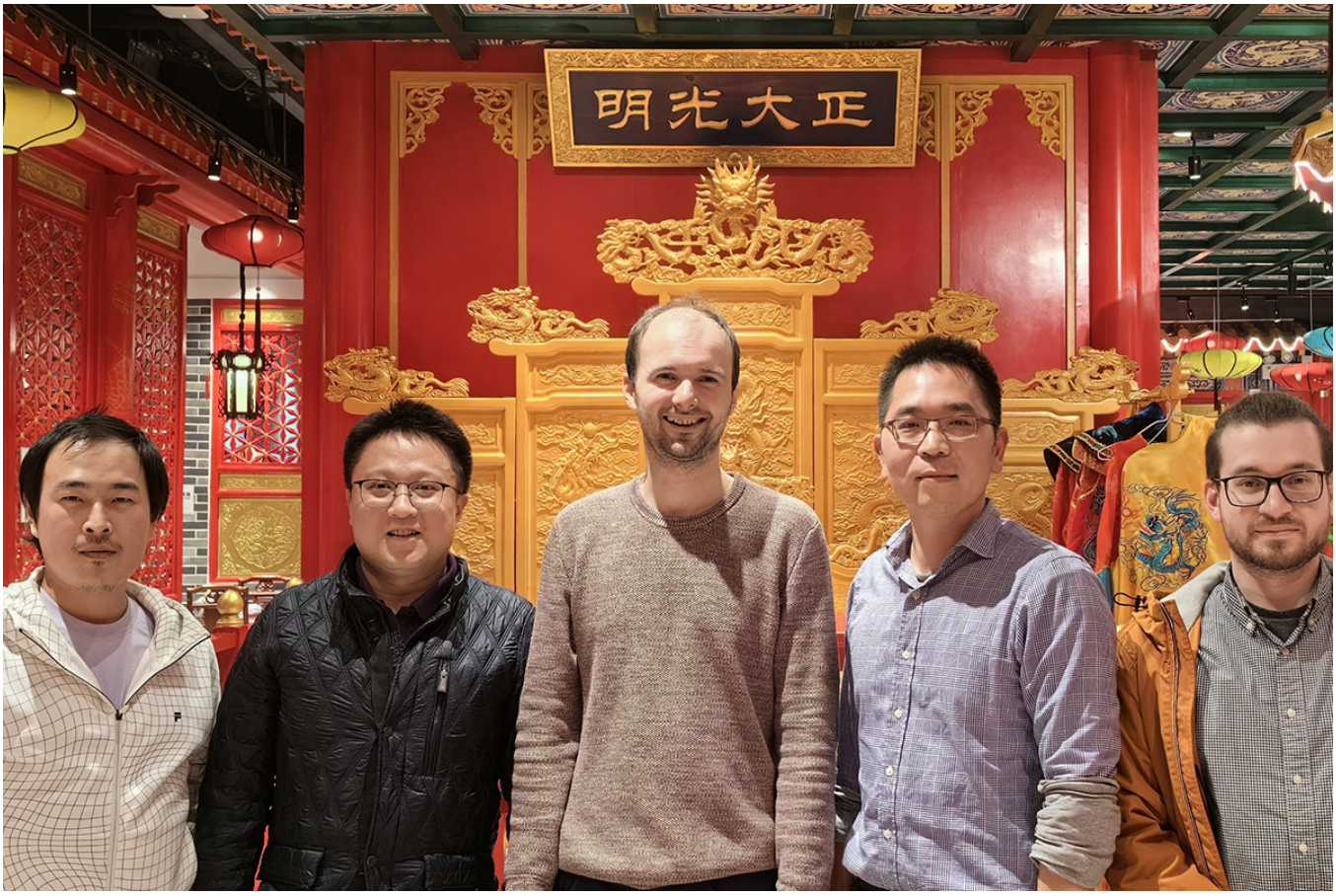
The unique capabilities of the Shanghai Center allowed SPbPU scientists to make significant progress in the implementation of research under the project «Blurring of structural switching and two-phase states in highly deformed epitaxial dielectric

heterostructures» supported by the Russian National Foundation (project number 20-72-10126). It represents part of a larger joint initiative of the SPbPU team in partnership with colleagues from Harbin Institute of Technology (HIT) and Southern Federal University (SFU), aimed at creating new thermal gateways from thin-film heterostructures.

Thanks to the development, it is possible to regulate thermal conductivity without mechanically moving any parts. For example, if clothes could independently transform from summer to winter and back again. Such technologies are used in space to adjust cooling systems, and on the ground for new types of solid-state coolers in electronics.

The goal has gotten closer due to a discovery made by HIT experts. They proved that by using an electric field in some types of heterostructures, the crystal structure can be changed, and with the change in crystal structure comes a change in thermal conductivity. The group led by Professor Chen, a synthesis specialist from HIT, was the first to grow the heterostructures needed for the project from a difficult but promising material, lead and hafnium oxide, by pulsed laser deposition.

The Chinese laboratory is one of the best in the world in synthesizing epitaxial thin-film heterostructures from oxides. The quality of their heterostructures in the area where we work exceeds the analogs of the best American laboratories. Our colleagues from China are very active in this field, intensively building scientific ties, successful in terms of scientific publications, open and proactive in cooperation, said Roman Burkovsky, head of the Russian team of the project, Associate Professor of the Higher School of Engineering and Physics at SPbPU.




The polytechnic took another important step in the research: they discovered a new type of crystal structures in antisegnetoelectric films, thus paving the way for the development of an international initiative. The experiment at the Shanghai Synchrotron Radiation Center was the first to achieve complete switching of the structure by an electric field, which was previously only partially possible. To date, no one else in world science has been able to achieve such results.

These studies lay a serious foundation for further development in Russia of scientific activities in the field of oxide antisegnetoelectric heterostructures, their synthesis, characterization, and construction of new devices from them. So far, much of the above is imported. Given the high global interest in this problem and its technological prospects, it is obvious that this area should be developed in Russia. To this end, Polytechnic is expanding its partnership with Russian organizations.

With colleagues from Rostov, we are trying to approach the same problem from a different angle, using lead-free antisegnetoelectric oxides. We already have the first results, and we will continue to work, explained Roman Burkovsky.

The solution of world-class scientific problems is only possible in cooperation with the leaders of these areas from partner countries. In November 2023, SPbPU signed an agreement with the Shanghai branch of the Chinese Academy of Sciences (CAS). According to the document, polytechnics can cooperate with

leading institutes of the Shanghai Branch of CAS for joint experiments, exchange of researchers, joint participation in conferences and other areas of work.

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