GIST holds presentation on development of surface design technology for future hypersonic vehicles < GIST (host) - Inha University - Seoul National University - Pusan National University Consortium >

- The 2024 Academic Conference of the Korean Society of Mechanical Engineers was held on Thursday, the 7th at the Jeju International Convention Center as a designated institution session, and Professor Solkeun Jee (principal researcher) of the School of Mechanical and Robotics Engineering served as the moderator.

- “The first domestically conducted integrated research process of simulation and experimental verification that is difficult even for advanced aerospace technology countries... It is expected to contribute to the development of space vehicles for space travel.”

▲ Professor Jaewook Lee of GIST introduces a technique to economically produce a porous surface with tens of millions of microscopic pores at the session of the Korean Society of Mechanical Engineers' Academic Conference, chaired by Professor Solkeun Jee: Research Results Presentation for the Development of Future Hypersonic Aircraft.

The Gwangju Institute of Science and Technology (GIST, President Kichul Lim) announced that it held a presentation on the results of its research (Development of Surface Microstructure Design Technology for Reducing Hypersonic Aerodynamic Heating, Principal Investigator: Professor Solkeun Jee, School of Mechanical and Robotics Engineering, GIST) for the development of future hypersonic aircraft.

The presentation was held on Thursday, the 7th, as a designated institution session at the Korean Society of Mechanical Engineers academic conference held at the Jeju International Convention Center.

The Agency for Defense Development and the Defense Acquisition Program Administration (DAPA) announced a public offering for the Future Challenge Defense Technology Research and Development Project (hereinafter referred to as the Future Challenge Defense Project), which is being promoted in a challenging and innovative manner to respond to changes in the future battlefield brought about by the 4th Industrial Revolution technology, although the weapon system requirement has not been determined or planned. With GIST as the host, a consortium consisting of four domestic universities (Inha University, Seoul National University, and Pusan National University) is carrying out the 'Hypersonic* Aerodynamic Heating* Reduction Project (Period: November 2022 ~ November 2025)*.

* hypersonic: Ultra-high-speed flow more than 5 times the speed of sound

* aerodynamic heating: Airflow phenomenon that heats the air around an aircraft due to high-speed flight

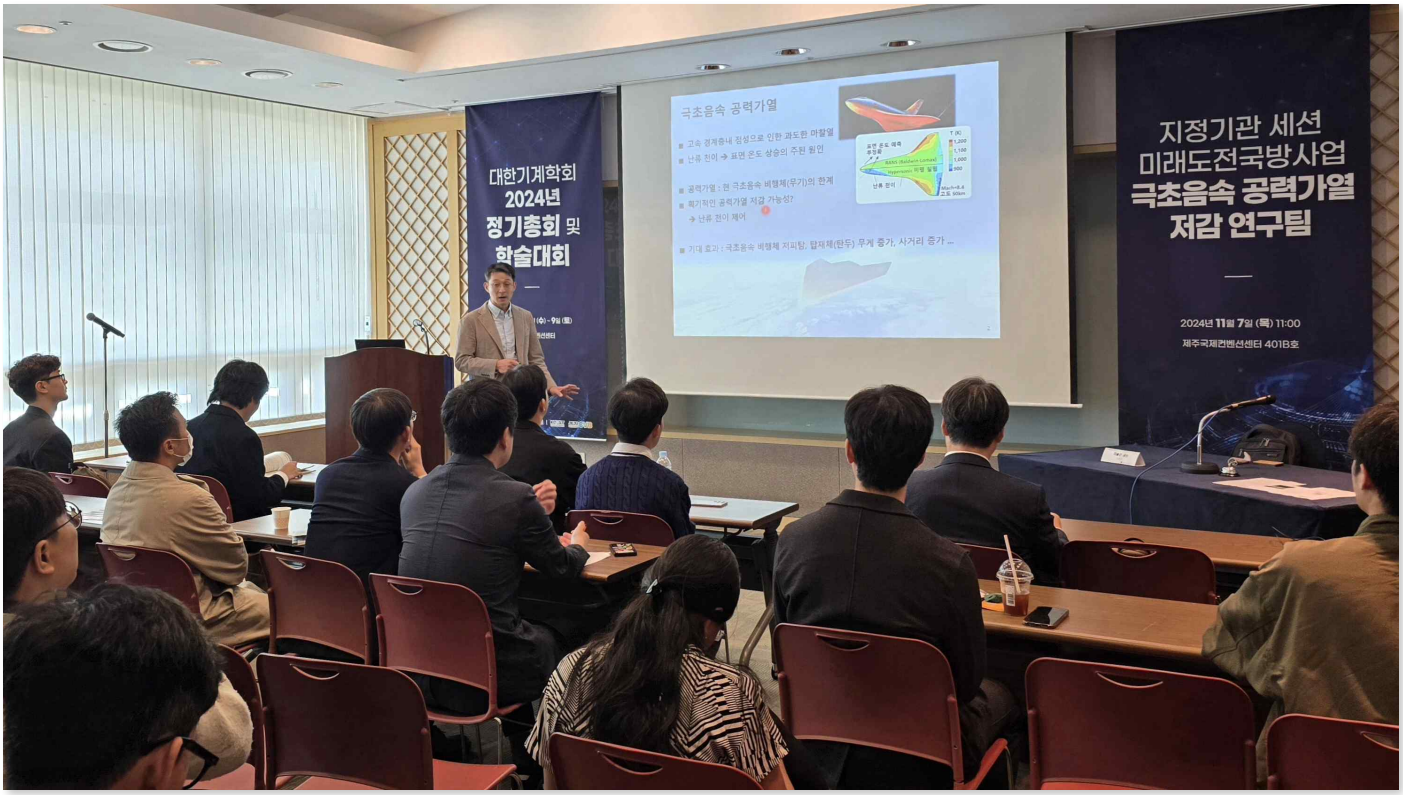
* This study is a future national defense technology research and development project supported by the Agency for Defense Development with funding from the government (Defense Acquisition Program Administration) in 2024 (No. 915067201, Project name: Development of surface microstructure design technology for reducing hypersonic aerodynamic heating).

The research team is conducting research to design and manufacture a porous surface composed of tens of millions of microscopic pores* to reduce aerodynamic heating that occurs in the extreme environment of hypersonic flow and contribute to the development of future hypersonic aircraft required for national defense purposes, and to demonstrate its aerodynamic heating reduction performance on a hypersonic ground experimental device.

* micropores: holes with a size similar to that of a human hair (50 to 100 micrometers)

On this day, a total of six research results were introduced, including five from GIST, which is in charge of the project, and one from Inha University, which is conducting hypersonic ground experiments.

First, Professor Solkeun Jee's lab at GIST, which is in charge of hypersonic flow simulation (presenters: Professor Solkeun Jee, Master's student Suhun Cho), precisely simulated the mechanism of turbulence in the very thin (about 1 mm) boundary layer flow on the surface of a hypersonic aircraft, and presented a method to suppress turbulence.



▲ Professor Solkeun Jee is precisely simulating the mechanism by which turbulence occurs in the extremely thin boundary layer flow on the surface of a hypersonic aircraft and explaining how aerodynamic heating can be reduced by suppressing the occurrence of turbulence.

Professor Jaewook Lee's laboratory at GIST, which designs and manufactures surface microstructures to produce hypersonic test specimens, introduced a technique to economically produce porous surfaces with tens of millions of micropores (diameters of 50 to 100 micrometers).

Professor Jae Hun Seol's lab at GIST (presenters: Ph.D. student Cheolyoung Kim, Master's student Yoonjae Lee) developed a technique to create a curved surface with very finely distributed micropores using MEMS technology used in semiconductor processes, demonstrating that MEMS technology can be used in the future defense and aerospace fields.

* MEMS: micro electro-mechanical system, a field that designs and manufactures ultra-small mechanical/electronic systems by utilizing semiconductor process technology

Professor Hyeong-jin Lee's research lab at Inha University, which is in charge of hypersonic ground experiments (Presenter: Dr. Deok-min Kim), developed a technique to measure hypersonic turbulent flow* within a very short experimental time (about 1/1000 second) due to the nature of hypersonic ground experiments, and experimentally confirmed that turbulence was suppressed by a porous surface, thereby suggesting the possibility of reducing aerodynamic heating.

* turbulent flow: A chaotic flow with very irregular changes in the flow field, making prediction and interpretation a very difficult field of engineering.

Professor Solkeun Jee, the research director, said, "The integrated research process of predicting hypersonic aerodynamic heating reduction techniques through simulation and verifying them through ground experiments is a challenging one that is difficult to carry out even in the United States and Europe, which are advanced aerospace technology countries, and this is the first of its kind in Korea. If the aerodynamic heating reduction technique is developed, it is expected to contribute to the development of space vehicles for space travel."

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