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HU-ACE NEWS LETTER

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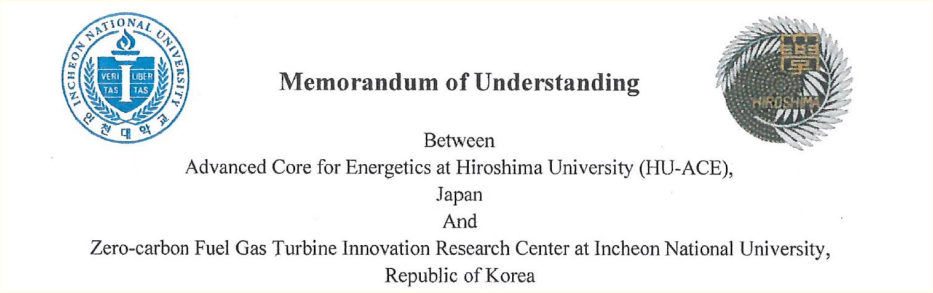
Activities of the Core

June 13, 2025	Special Lecture on Carbon Recycling (NEDO Project) – 2nd Session: Harmonization of Biomass-based Carbon Recycling Technologies with the Environment (co-organized by HU-ACE)
June 19, 2025	The 18th Hiroshima University Biomass Premium Evening Seminar (co-organized by HU-ACE)
June 20, 2025	The 105th HU-ACE Steering Committee Meeting
June 21, 2025	Higashihiroshima Energy & Eco Seminar – 1st Session: 'Why is the Earth's Temperature Rising? – Global Warming' (co-organized by HU-ACE)
June 26, 2025	The 11th Ground Thermal Energy Seminar (hosted by HU-ACE)
June 30, 2025	The 9th International Symposium on Fuels and Energy (ISFE2025) Seminar (co-organized by HU-ACE)

Conclusion of the Memorandum of Understanding (MOU) with the Zero-carbon Fuel Gas Turbine Innovation Research Center, Incheon National University, Republic of Korea.

On May 12, 2025, our research center signed a Memorandum of Understanding (MOU) with the Zero-carbon Fuel Gas Turbine Innovation Research Center at Incheon National University (Republic of Korea). The research center at Incheon National University is actively engaged in advanced research on gas turbine technologies utilizing zero-carbon fuels. Through this MOU, we anticipate significantly enhanced research and educational exchanges between our two universities, providing increased opportunities to share mutual knowledge and technologies. We look forward to building a stronger partnership through the promotion of joint research projects and active exchange of students and faculty members, thereby contributing to the advancement of energy technologies.



Memorandum of Understanding

Between
Advanced Core for Energetics at Hiroshima University (HU-ACE),
Japan
And
Zero-carbon Fuel Gas Turbine Innovation Research Center at Incheon National University,
Republic of Korea

Related Events

Jul. 31, 2025: 16:20-17:50 The 122nd Hiroshima University Biomass Evening Seminar (co-organized by HU-ACE)
Contact us for more information : hu-ace-info@ml.hiroshima-u.ac.jp

Research consultation and joint research are welcome.

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HU-ACE Secretariat, URA Division, Office of Research and Academia-Government-Community Collaboration, Hiroshima University 1-3-2 Kagamiyama, Higashi-Hiroshima, 739-8511 Japan
E-mail: hu-ace-info@ml.hiroshima-u.ac.jp, tel:+81-82-424-4425, URL: https://hu-ace.hiroshima-u.ac.jp/en/

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Do You Know Energy? No. 3

Plasma window

Shinichi NANBA
Professor, Graduate School of Advanced Science and Engineering

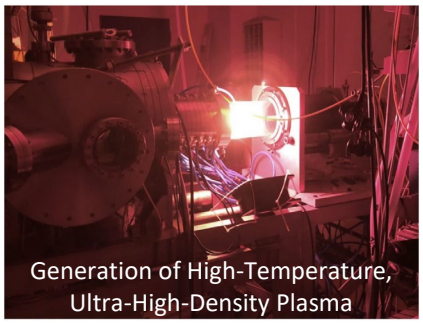
Research fields:
Physical and Mathematical Sciences / Plasma Physics
Keywords:
Plasma Spectroscopy, Atomic Processes, X-ray Lasers

What is a Plasma Window?

To create a vacuum, a metal or glass chamber is typically used, and the air inside is removed using a vacuum pump. However, when there is a physical barrier like this, particles such as electrons, ions, or soft X-rays cannot pass through freely. It's similar to how visible light from the sun can pass through a glass window, but air (wind) cannot. A plasma window functions as a virtual vacuum window—it allows specific particles or light generated in a vacuum to pass through while blocking air. In this way, it creates a non-physical, virtual barrier between vacuum and atmosphere.

How is a Plasma Window Created?

A plasma window is formed using high-temperature, high-density thermal plasma within a narrow metal tube. In such plasma, the temperature and viscosity of the gas become extremely high, significantly reducing gas flow and suppressing plasma-generating gas movement. As a result, instead of using a solid barrier, a virtual "plasma wall" is created, which serves as a pressure boundary separating atmospheric pressure from vacuum. The key to realizing a plasma window lies in the ability to generate and sustain high-temperature, high-density plasma capable of forming a strong pressure boundary.



Generation of High-Temperature, Ultra-High-Density Plasma

Why are Plasma Windows Important?

Because a plasma window can act as a pressure barrier, it allows vacuum-based processes—such as electron beam machining, semiconductor microfabrication, and the development of functional materials—to be carried out with reduced vacuum requirements. We are particularly interested in applying this to electron beam welding in atmospheric conditions. Typically, electron beam processing must be performed in a vacuum, because electrons easily collide with other particles in air, causing scattering and attenuation before reaching the target material. If electrons generated in a vacuum can be transmitted through a plasma window into the atmosphere, it becomes possible to perform welding or precision machining directly in open air.

What Can Plasma Windows Enable in the Future?

Traditionally, electron beam processes required that the workpiece be placed inside a vacuum chamber, limiting their application to small or medium-sized objects. With the realization of plasma windows, electrons can be delivered into the atmosphere, making it possible to apply electron beam processes to large-scale structures. This opens up potential applications in aerospace (aircraft and rockets), maritime (ships), civil engineering (bridges), and other fields that demand precision processing. Plasma window technology is expected to contribute significantly to the creation of a safe and secure society by enabling new approaches in infrastructure manufacturing and maintenance.