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HU-ACE NEWS LETTER

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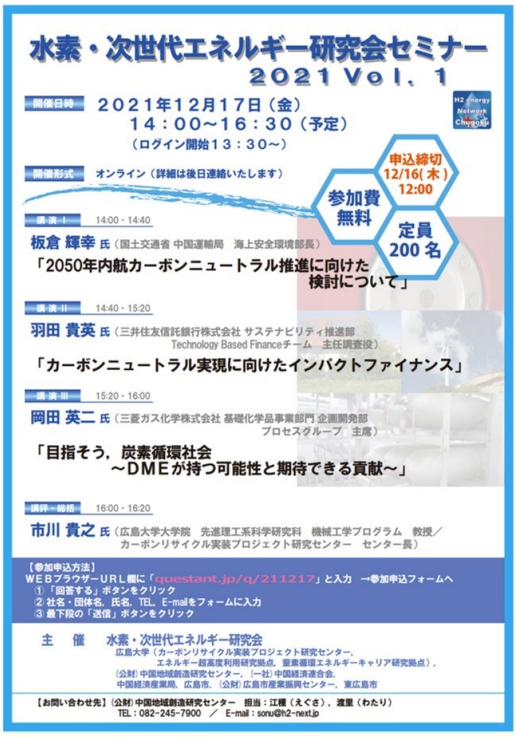
Activities of the Core

Dec. 8, 2021	Biomass was introduced in the special feature on carbon neutrality at HU-Plus Vol.17
Dec. 10, 2021	he 66th HU-ACE Steering Committee Meeting.
Dec. 13, 2021	The 4th Hiroshima University Biomass Premium Evening Seminar (co-organized)
Dec. 17, 2021	Society for the Hydrogen energy and Next-generation energy Utilization ～ Seminar 2020 vol.1(co-organized)

Hydrogen / Next Generation Energy Seminar 2021 Vol.1

On December 17, 2021, "Hydrogen / Next Generation Energy Seminar 2021 Vol.1" was held via online, which was co-sponsored with the Chugoku Bureau of Economy, Trade and Industry, the Hiroshima City Industrial Promotion Center, the Chugoku Economic Federation, the Chugoku Regional Innovation Research Center, and Higashi-Hiroshima City. The series of this seminar has already been lasted for 15 years. Mr. Itakura provided the topic of "Considerations for Promotion of Domestic Carbon Neutral in 2050" and Dr. Takahide Haneda and Mr. Okada gave lectures about "Impact Finance for Realizing Carbon Neutral" and "Carbon Circulation Society-Potential and Expected Contribution of DME", respectively. Approximately 100 participants attended this seminar and received hints on what to do now toward the realization of carbon neutrality in 2050.



Seminar pamphlet

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Research Topics

Development of high-density plasma source

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Research fields: Plasma engineering
Keywords: Plasma diagnostics, Turbulence, Tomography, Cascade arc discharge

Abstract

Background: Demand for high-density plasma

Since the high-density plasma (FIG.1) shows reactive nature and contains high thermal energy, it is used for material coating[1] and thrusters[2]. The Plasma window (PW) is yet another example of high-density plasma application, which separate atmospheric pressure and vacuum using plasma[3]. The PW heats the gas passing through a narrow channel by the high-density plasma to increase the viscosity of the neutral gas. The increased viscosity sustains the pressure gradient between the atmosphere and vacuum. The key feature of PW is that it can transmit electron and ion beams into the atmosphere while separating the atmosphere and vacuum. Due to this feature, PW is believed to pave a way for a new application of quantum beam science. To realize the new plasma application, it is necessary to realize a new plasma source with higher density and longer operation time.

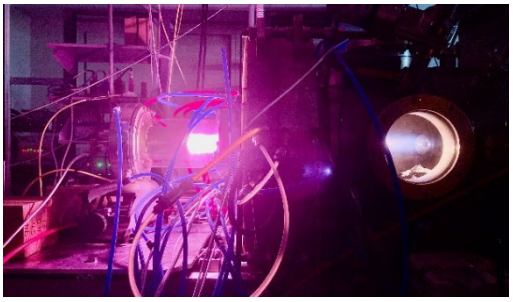

FIG.1 Example of high-density plasma.

Methods: Hollow cathode + cascade arc discharge

To produce higher density plasma for a long time, we developed a cascade arc discharge device that uses a hollow cathode (see FIG. 2). The hollow cathode is a cylindrically shaped electrode (see FIG. 2) that can produce high-density plasma inside the cylinder. Compared with the needle-shaped electrode previously used for cascade arc discharge, the hollow cathode has a larger surface area, which can reduce the heat load and can facilitate a longer discharge duration.

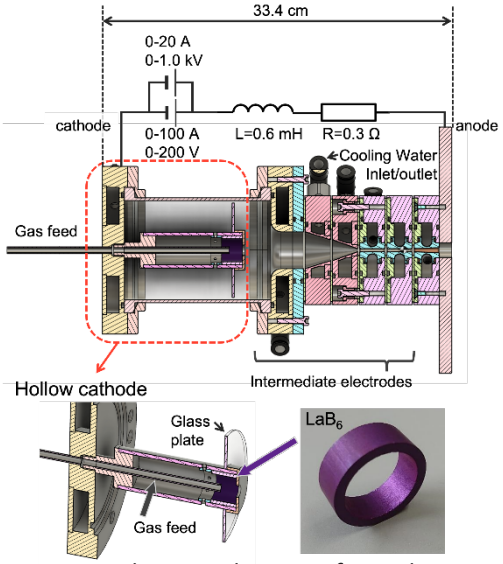

FIG. 2 Schematic diagram of new device.

Results: Successfully produced high density plasma using hollow cathode

Using the spectroscopic measurement system, we confirmed that the newly developed device can produce high-density plasma (~10^{16} cm^{-3}. see FIG.3). Also, it is confirmed that the pressure separation capability increase as the plasma temperature increases (see FIG.4).

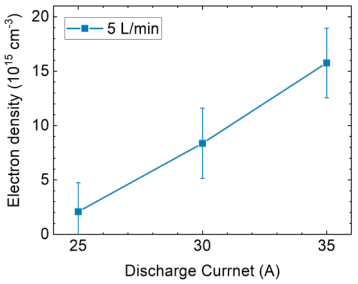

FIG.3 Density dependence on discharge current.

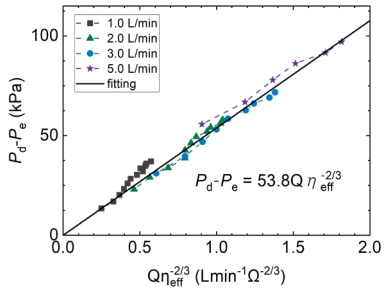

FIG.4 Pressure separation capability of newly developed device.

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