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Activities of the Core

Nov. 5-6, 2019	The 8th joint Conference in Renewable Energy and Nanotechnology 2019(JCREN2019) (co-organization)
Nov. 6, 2019	Society for the Hydrogen energy and Next-generation energy Utilization ～ Seminar 2019 vol.1
Nov. 7, 2019	Prof. Ichikawa presented in the Radio Program "Cool Choice Now“
Nov. 11, 2019	Research seeds presentation by young researchers at Hiroshima University(co-organization)
Nov. 12, 2019	Ehime New Energy Introduction Promotion Council Hydrogen Subcommittee Study Session.
Nov. 18, 2019	The 79th Hiroshima University Biomass Evening Seminar (co-organization)
Nov. 19-21,2019	The 25th Small Engine Technology Conference (SETC)

Joint Conference in Renewable Energy and Nanotechnology(JCREN)2019

Following the holding in Yamaguchi last December, the 8th Joint Conference on Renewable Energy and Nanotechnology (JCREN2019) was held in Makassar, Indonesia on November 5-6, 2019. HU-ACE also co-hosted this meeting. 65 participants mainly from Asian countries joined. After the active discussion on the first day, participants visited Bili-bili Hydroelectric Power Plant on the second day as a part of technical tour. Presentation by Takumi Harada, Ph.D. student of HU-ACE, and six co-authors received the Excellent Paper Award (Toyo Koatsu). The next meeting will be held in 2020 at Khon Kaen University in Thailand.

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Research Topics

Plasma windows

-Innovative vacuum interface by atmospheric plasmas-

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Research fields: Plasma Engineering

Keywords: Arc plasma, Laser plasma, Plasma window, Plasma X-ray source

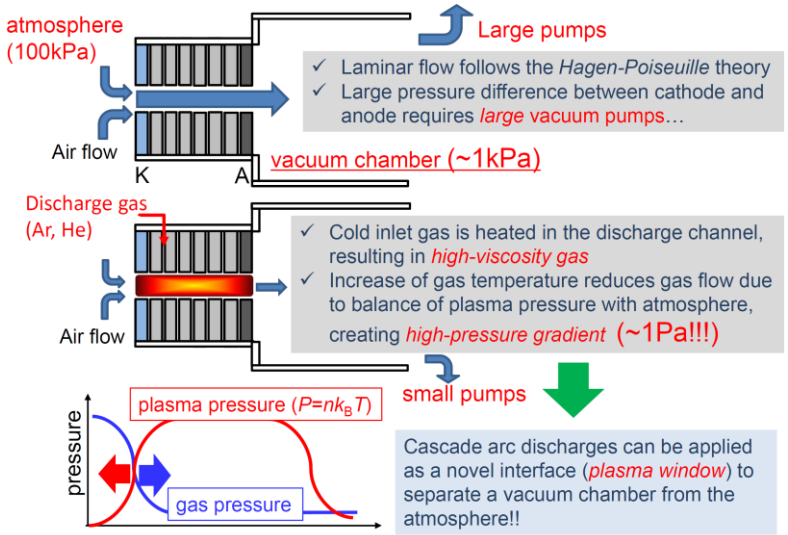
Abstract

Background

In order to separate vacuum and atmosphere, vacuum vessels made of metal and glass materials have been employed, through which charged particles and soft X-ray cannot directly be extracted. The concept of ***plasma window*** is that the hot dense plasma generated in an arc discharge can create substantial pressure differences. The high-temperature gas and its high viscosity greatly suppress the gas flow in the plasma channel, resulting in a steep pressure gradient. Many applications, such as **charged particle processing in air**, **alternative X-ray window**, and **differential pumping** creating a large pressure gradient have been proposed.

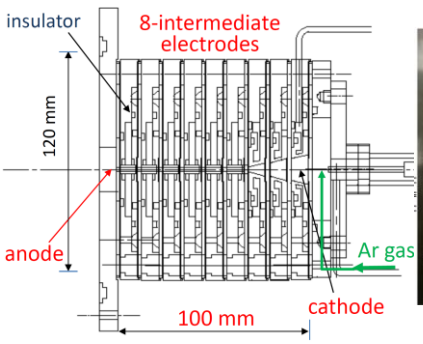
Methods

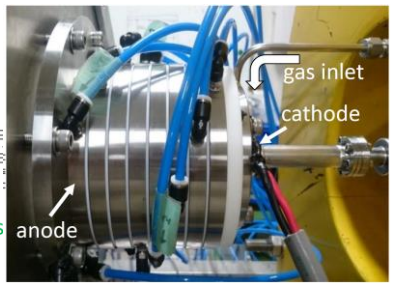
For realization of practical plasma window, the pressure gradient with 5 orders of magnitude is one of the indexes. Generation of atmospheric plasma with a high temperature (10,000 K) and high density (10^{17}/cc) is essential. By employing the so called cascaded arc discharge method, we investigate the possibility as the windowless plasma window device. In addition, emission spectroscopy and laser spectroscopy reveal the plasma parameters of electron temperature and density.



Results

A compact arc discharge source having a 3-mm diameter is fabricated, and 100 kPa Ar thermal plasma of electron temperature and density of 10,000 K and 10^{17}/cc, respectively, is generated. Although arc discharge generates a pressure gradient of 100 kPa–100 Pa through the discharge channel, this value is insufficient for the practical use. The reason for low pressure gradient is explained by a low gas temperature (1,500 K). Thus, we need to increase the gas temperature to 13,000 K, at which the viscosity has a maximum value.





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