NEWS RELEASE

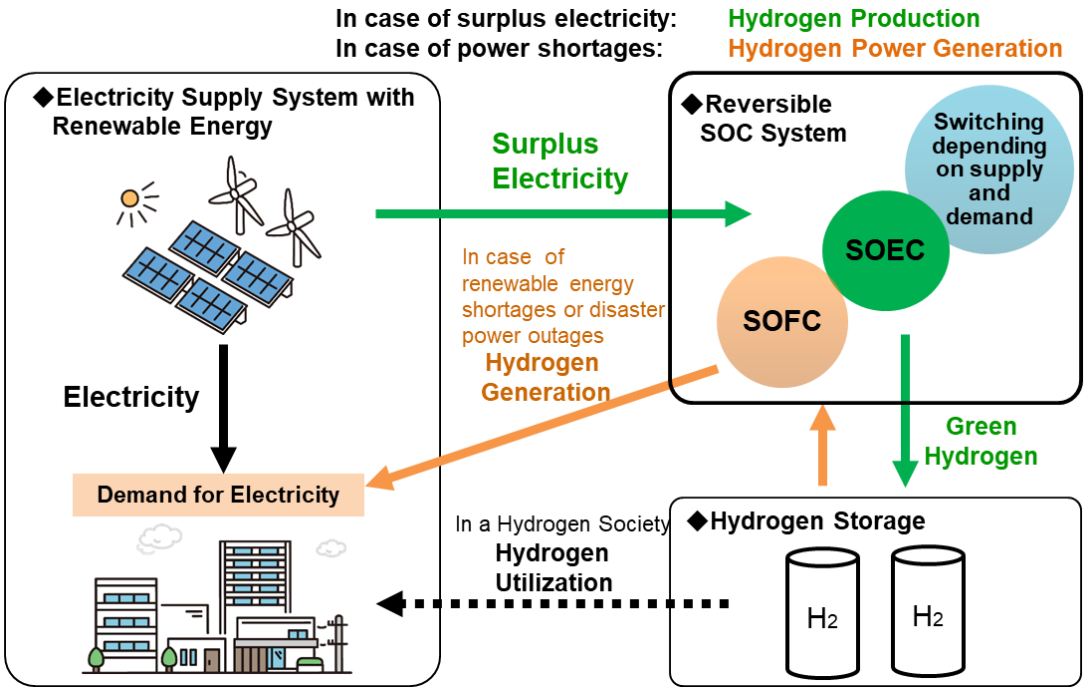
Niterra Co., Ltd.

Announcement of Development of a Compact Reversible SOC System Capable of Hydrogen Production and Power Generation

NAGOYA, JAPAN, March 27th, 2024 — Niterra Co., Ltd. (hereafter the Company), Japan's leading spark plug and ceramics manufacturer with an evolving portfolio focused on ceramics and beyond, has announced the development of a "reversible SOC (Solid Oxide Cell) system" using the SOC they already have under development. This SOC system combines hydrogen production by steam electrolysis and power generation by fuel cells in a single-cell stack.

◆Background of the Development

In recent years, renewable energy-derived electricity has been increasingly introduced to realize a carbon-neutral society. However, as the percentage of renewable energy in society increases, further curtailment of surplus power output is expected to increase, making using surplus power a social issue. One solution to this problem is to convert surplus electricity into hydrogen, store it, and use the stored hydrogen to generate electricity in the event of power shortages or power outages during disasters. To address this issue, we have applied our fuel cell technology to develop a "reversible SOC system" that enables hydrogen production through steam electrolysis and power generation through a fuel cell with a single cell stack.



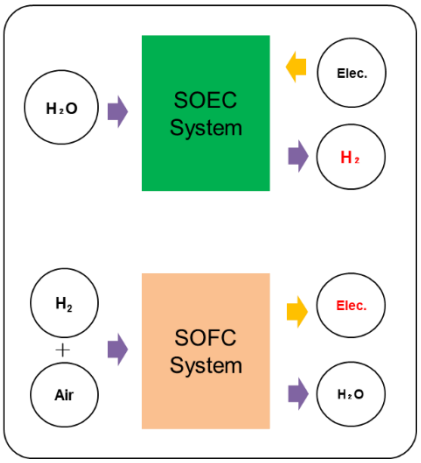
◆Features and Functions of the System

Our cell stacks can operate in two ways: SOEC, which uses electricity to generate hydrogen, and SOFC, which uses hydrogen and air to generate electricity. Neither of these technologies emit CO_2 or other greenhouse gases and are essential for achieving carbon neutrality. Since a single stack can switch between hydrogen production and electricity generation, the system can be more compact than a combination of SOEC and SOFC, with advantages such as a smaller footprint.

In SOC systems, a cell stack must be maintained at a high temperature of around 700 ℃, and management of this thermal energy dramatically affects the efficiency. This system is equipped with a compact, high-efficiency hot module*1 that can effectively utilize heat generated internally and utilizes technologies for controlling electrochemical properties of the cell stack in high-temperature environments and thermo-fluid analysis technologies that we have developed over many years.

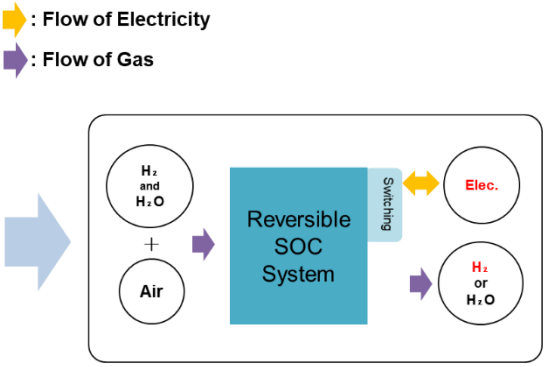
＜When SOEC/SOFC Systems Are Installed Together＞

-Two systems are required.
-The footprint is large, and infrastructure is required for each system.



＜For Reversible SOC systems＞

-Hydrogen production and power generation functions are integrated into one compact system.
-Reversible operation is possible by switching command.



＜External View of the System＞



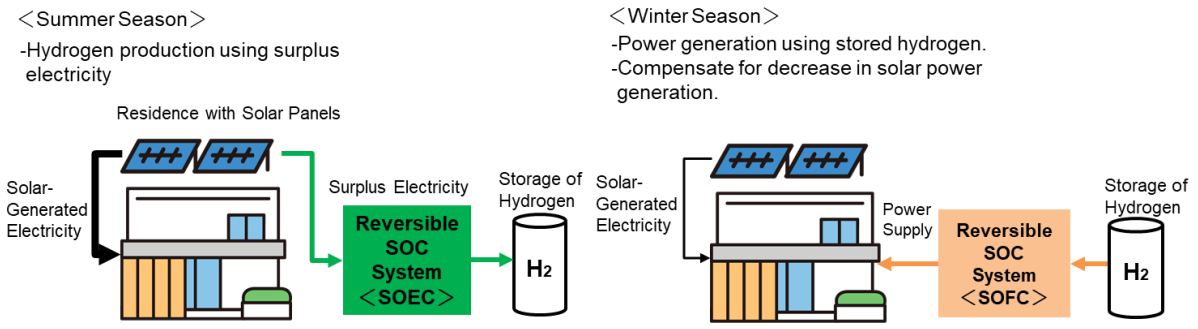
＜Main Specifications＞

IN	Electricity (For control of the system)	AC100V
	Water	Municipal Water 0.15MPa and above
	Air	0.2MPa and above (Self-sufficiency also possible)
	Hydrogen	0.2MPa and above
SOEC	Amount of hydrogen produced *2	Up to 0.9Nm³/h
	Electric to hydrogen efficiency *2	4.4kWh/Nm³
SOFC	Power generation *2	Up to 740W
	Power generating end efficiency *2	46%LHV
SOC Operating Temperature		700～750 ℃
Round trip efficiency		31%
SOEC/SOFC Transition time		Up to 60min
External Dimensions		W1000×D400×H1800

◆System Usage Scenes

By combining photovoltaic power generation, which has large seasonal fluctuations in power generation, with a hydrogen storage system, it is possible to adjust the supply and demand of electricity between seasons by using SOEC to convert and store surplus power in summer into hydrogen and using SOFC power generation with hydrogen stored in summer to make up for any power shortages in winter.

The SOC system can also be an emergency power source since it can generate electricity anytime using stored hydrogen and flexibly supply energy day and night. SOC systems can also be offered as an emergency power source.



◆Future Prospects

We will verify the system as an energy management system while conducting a demonstration in fiscal year 2024. During the demonstration, we plan to obtain durability and operation results in combination with a hydrogen storage system while making improvements to increase the conversion efficiency of the SOC system, In addition, we will conduct educational activities to promote the use of SOC systems in society, search for collaborative partners, and aim to commercialize the system by the end of fiscal year 2025.

In the SOC business, we aim to become a leading company that can provide cell stacks, hot modules, and systems to a wide range of customers and contribute to building a sustainable society.

*1: A hot module is a structure consisting of a cell stack, heat source, gas piping, and insulation material. It is capable of raising the temperature of the cell stack to around 700°C with high efficiency and maintaining the high temperature.
*2: Figures measured at the electrode end of the hot module.
*3: Percentage of power remaining when the power used for hydrogen conversion by SOEC is set to 100% and the hydrogen is converted back into electricity by SOFC.

About Niterra

Founded in Nagoya, Japan in 1936, Niterra Co., Ltd. (formerly NGK Spark Plug Co., Ltd.) is renowned for its NGK-branded spark plugs and NTK-branded ceramic products. Niterra, a coined word combining the Latin words "niteo" (shine) and "terra" (Earth), was introduced in April 2023 to express the reborn company's commitment to sustainability through an evolving portfolio focused on ceramics and beyond. Under the corporate message "IGNITE YOUR SPIRIT," Niterra is now expanding into the growth fields of mobility, healthcare, environment and energy, and communications. The company's consolidated revenues in fiscal 2022 (to March 2023) totaled 562.6 billion yen (4,167 million USD). Niterra has 33 bases in Japan and 59 overseas, and more than 16,000 employees worldwide. Please visit https://www.ngkntk.co.jp/english/