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Development of Energy-Saving Atmospheric Gas Generation Technology for Heat Treatment with 80% Reduction of CO₂ Emissions Using Oxy-Fuel Combustion Technology

Taiyo Nippon Sanso Corporation (Head office: Shinagawa ward, Tokyo; President: Kenji Nagata; hereinafter, "TNSC"), a Japanese industrial gas business company in the Nippon Sanso Holdings Group, has developed an atmospheric gas generation process for heat treatment furnaces using oxy-fuel combustion technology. The conventional technology required high power consumption by electric heating, but it is now possible to achieve 80% reduction effect of CO₂ emissions by using oxy-fuel combustion technology. TNSC will utilize the developed process technology to investigate the practical use for heat treatment furnaces in a wide range of industries that utilize heat treatment for component processing and so on, thereby aiming at early commercialization of this technology.



Burner
section

Catalyst
section

1. Background of Development

- In Japan, about 1.12 billion tons of CO₂ are emitted annually, 13.5% of which comes from industrial furnaces for heat treatment and so forth. About 37,000 such industrial furnaces are reported to exist in Japan. To meet the government's goal of carbon neutrality by 2050, we need to take some measures to reduce CO₂ emissions from these facilities.

Conventional endothermic atmospheric gas generators mix a hydrocarbon-based gas, such as liquefied propane gas or liquefied natural gas, with air to produce atmospheric gas through endothermic reactions using a nickel catalyst. However, since such a nickel catalyst must be

heated to a high temperature of 1,000°C or more, enormous power is required.

- TNSC has long proposed nitrogen-based heat treatment. For this reason, we had focused on atmospheric gas generation technology, which is an energy-intensive technology, and developed the "Energy-Saving Oxy-Fired Atmospheric Gas Generation Technology" in 2013. This time, based on this technology, we have re-examined and brushed up on the elemental technology and have realized a new process that utilizes the oxy-fuel combustion technology and not only generates CO + H₂ in high concentrations, but also successfully generates a gas with a composition comparable to the conventional atmospheric gas.
- TNSC is promoting the business globally to apply its expertise in industrial gas application technology, such as oxy-fuel combustion and heat treatment, to innovative product development or streamlined production as well as carbon neutrality on the basis of "Exploring New Business toward Carbon Neutral Society," which is one of the five key strategies of the Nippon Sanso Holdings Corp.'s medium-term management plan "NS Vision 2026 - Enabling the Future-", and "Expanding Solution Business" as the growth strategy for the industrial gas business in Japan.

2. Outline of Technology

- TNSC has achieved significant energy savings with our long-developed oxy-fuel combustion technology, which uses the heat generated through the combustion of flammable gases with oxygen as the energy required for catalyst reactions.
- By further optimizing the combustion conditions of the oxygen burner, the gas generator structure, gas control, and the catalyst, we have achieved an 80% reduction in CO₂ emissions as compared to the conventional technology.
- By applying this technology, it is possible to provide energy-saving atmospheric gas technology that can generate atmospheric gas required for various heat treatments.

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