March 8, 2021

Notice Regarding Development of High-Efficiency Oxygen Utilization System for Electric Arc Furnace Steelmaking Linked to Laser Gas Analyzers

Taiyo Nippon Sanso Corporation ("TNSC") hereby announces that it has combined oxygen applications for electric arc furnace steelmaking processes with laser gas analyzers, and developed technology to improve oxygen utilization efficiency in electric arc furnace steelmaking.

1. Background to Product Development

Oxygen applications, such as oxygen burners and lances, are often installed and used in electric arc furnaces for the purpose of improved productivity and energy savings in electric arc furnace steelmaking processes.

TNSC has used SCOPE-Jet®, a high-speed oxygen burner lance, in electric arc furnace steelmaking processes since 2001. In 2017, TNSC developed a new type of SCOPE-Jet® with further enhanced performance that also supports low-pressure, low-calorie fuels (announced in the December 25, 2017 news release).

For technology that reduces power consumption even further, TNSC is also developing "SCOPE-Jet® Post Combustion", which effectively utilizes thermal loss of the emissions that account for approximately 30% of electric arc furnace heat. "SCOPE-Jet® Post Combustion" achieves energy savings by conducting secondary combustion of unburnt gases within the electric arc furnace and heating scrap material.

TNSC has recently launched optimized oxygen injection technology linked to oxygen applications and laser gas analyzers with the expertise it has cultivated so far through the electric arc furnace steelmaking process to address market demand for cost reductions driven by the recent rise in electricity charges and secondary material costs and to improve the efficiency of oxygen applications. This has reduced oxygen consumption by approximately 20% compared to the conventional operation using "SCOPE-Jet® Post Combustion".

2. Technical Overview

Post combustion involves enriching unburnt gases (such as CO and H_2) generated from raw material scrap, carbon material, and fuel within the electric arc furnace during melting in electric arc furnace steelmaking processes with pure oxygen from oxygen lances installed in the furnace walls. This helps to achieve combustion, preheat the scrap, reduce power consumption and improve productivity. Since the composition of unburnt gases that are generated changes by the second, it is necessary to accurately assess the composition of emissions and appropriately control the volume of oxygen supplied.

By analyzing the composition of emissions generated by the electric arc furnace and its operational patterns and conducting numerical analysis of the flow of gas within its exhaust duct, TNSC has optimized the position for measuring emissions.

The laser gas analyzers handled by TNSC to measure emissions utilize TDLAS (Tunable Diode Laser Absorption Spectroscopy) and produce continuous and instant measurements (response speed: ~2 seconds) of CO, CO_2, and H_2O components as well as temperature using a single laser. (Chart 1)

In addition, TNSC has newly developed a system for controlling the volume of oxygen flow to allow the optimal volume of oxygen to be supplied in relation to changes in the concentration of the composition of emissions. (Fig. 1, Fig. 2)

In comparison to the conventional operation, this has eliminated the need to inject excess oxygen and has made it possible to reduce oxygen consumption. This technology can be linked with other applications used in electric arc furnace steelmaking processes (such as oxygen burners, foundry lances, and carbon injection) and allows for the following controls based on the composition and temperature of emissions.

・Reduces costs by controlling the volume and timing of oxygen, fuel, and carbon injections
・Reduces power consumption by controlling the volume of air expressed from the exhaust fan
・Prevents accidents through early detection of water leaks

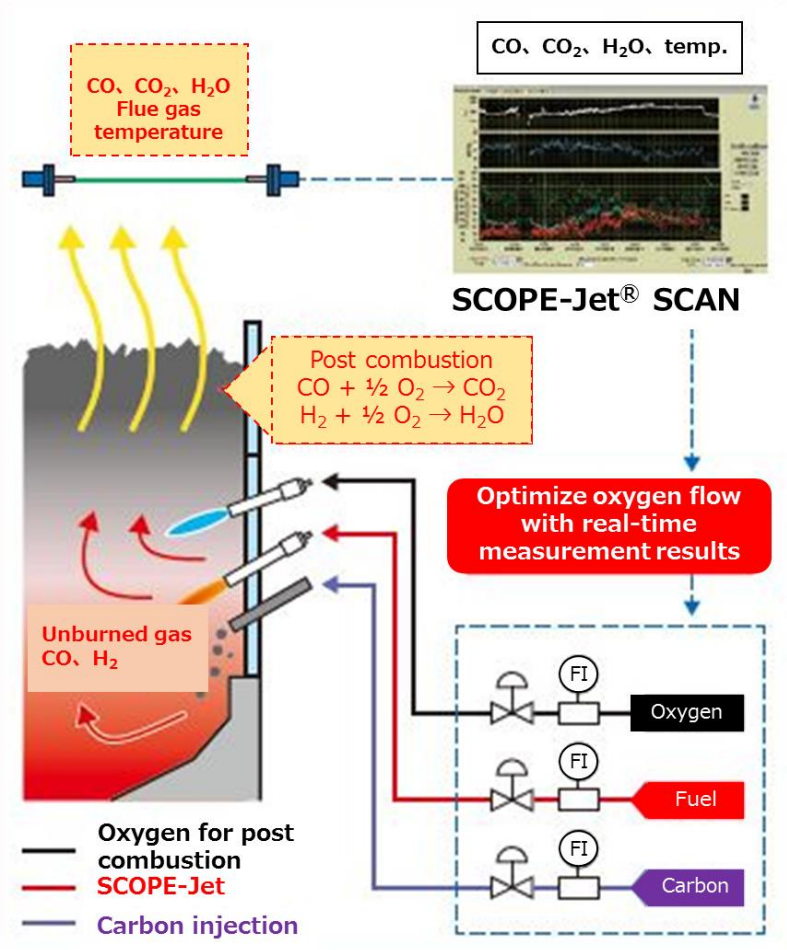

Fig. 1 SCOPE-Jet® SCAN system Overview

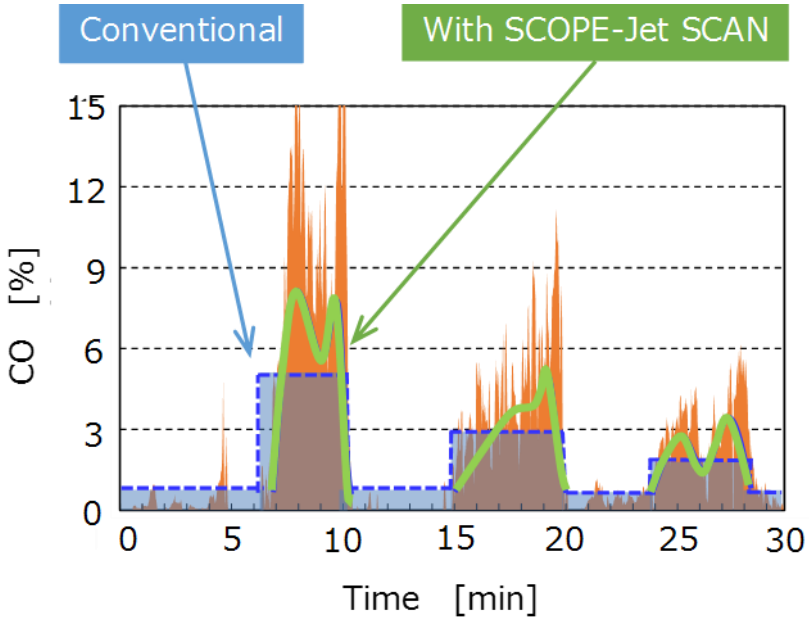

Fig. 2 SCOPE-Jet® SCAN controls the volume of oxygen flow

Chart 1 SCOPE-Jet® SCAN Specifications

Measured component		Range	Precision
CO	[%]	2 ～ 80	±2%abs
CO_2	[%]	2 ～ 80	±1%abs
H_2O	[%]	1 ～ 50	±1%abs
Temperature	[℃]	260～1700	±1.5%FS

3. Future Plans

TNSC previously developed the SCOPE-Jet® and Innova-Jet® series for electric arc furnace steelmaking processes, achieving increased productivity and energy savings. In the future, in order to improve oxygen utilization efficiency, oxygen burner lances and carbon injection will be integrated into SCOPE-Jet® SCAN, which incorporates laser gas analyzers. TNSC expects that this will achieve further operation improvements in electric arc furnace steelmaking processes, which produce fewer carbon emissions in crude steel production than blast furnaces.

TNSC also aims to use this application that incorporates laser gas analyzers in heating furnace and converter processes, mainly in the steelmaking field.

Taiyo Nippon Sanso Corporation
Tnsc.Info@tn-sanso.co.jp