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Taiyo Nippon Sanso Corporation

Launch of oxy-enriched burner "Innova-Jet® Swing" based on self-induced oscillation

A new oxy-enriched burner "Innova-Jet® Swing" developed by Taiyo Nippon Sanso Corporation (TNSC) provides a new way of directing the flames more evenly over a wider area via self-induced oscillation. It is on sale for use in tundish preheaters as part of the electric-arc furnace steelmaking processes.

1. Background to product development

Oxy-enriched combustion technology is widely used in incineration processes to help save energy and lower emissions of oxide gases by heightening flame temperatures and reducing thermal losses. However, more advanced technical solutions are needed to help control temperature distribution within the incinerator to achieve greater temperature uniformity and prevent issues related to local superheating.

TNSC has developed the oxy-enriched burner "Innova-Jet® Swing" based on a completely new concept using self-induced oscillation.

2. Technical overview

Self-induced oscillation with fuel combustion is based on using a specially designed nozzle to counter the natural tendency of the fluid jet to stay attached to the nearest surface, a phenomenon known as the Coandă effect. The result is the spontaneous oscillation of the fluid jet without external intervention. Applied to a burner, this causes the flames to change direction in a cyclical manner (see Photo 1), increasing the affected area. The design eliminates the need for a mechanical propulsion unit, and creates a simple combustion burner with better maintenance characteristics.

Photo 1: Flame jets from the Innova-Jet® Swing

TNSC has successfully optimized the technical design of the burner for stable self-induced flame oscillation with a swing of up to 60˚. This results in efficient and uniform heating of a surface area roughly double that achieved with conventional burners that emit straight jets of flame.

3. Potential applications

One of the potential applications of the Innova-Jet® Swing technology is in the tundish preheaters used in the steelmaking process. A tundish is a holding vessel for molten metal used in continuous casting, in which the steel is poured continuously into molds to set slowly. The long, shallow structure of the tundish means that the molten steel must usually be preheated to more than 1,000˚C before pouring (see Figure 1).

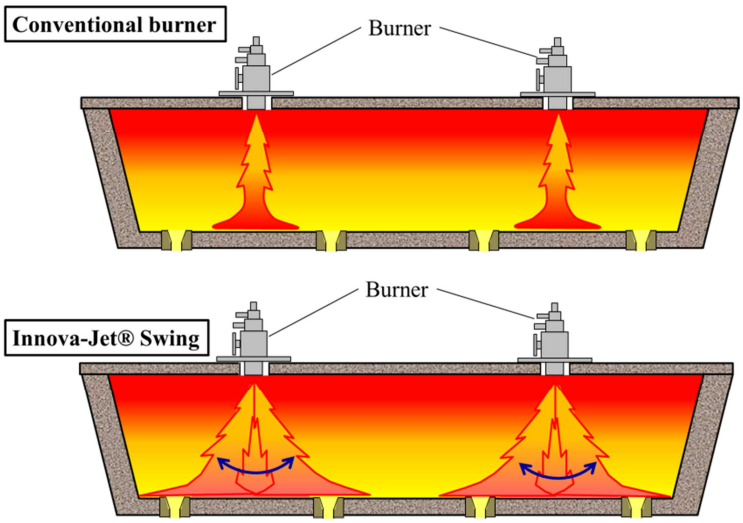

Figure 1: Tundish application for burners

It is hard to achieve an even temperature distribution on a horizontal-type reactor with a conventional burner. The use of oxy-enriched combustion has led to the issue of locally superheated spots occurring directly below the burners, thereby reducing the longevity of the reactor vessel due to incineration damage. This problem did not typically occur with the conventional air combustion burners.

TNSC has conducted tests on the Innova-Jet® Swing using a quasi-tundish vessel set-up. The results for the temperature distribution at the base of the vessel show that the swing effect, which spreads the flames over a much wider area, leads to a more even distribution of temperatures with the Innova-Jet® Swing than with a conventional burner. It also clearly eliminates any local superheating (see Figure 2).

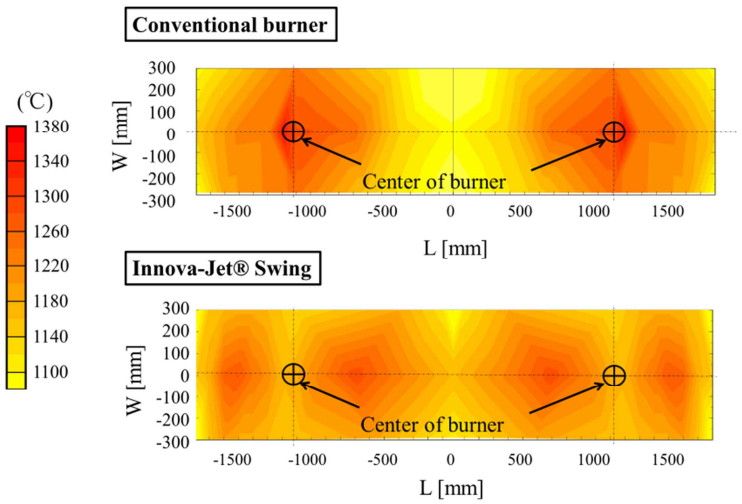

Figure 2: Temperature distribution for base of quasi-tundish vessel

4. Future development

Previous tests by TNSC using a tundish prototype have shown that Innova-Jet® technology can cut fuel consumption by 40% compared with conventional incineration burners. Lower fuel usage also translates to a reduction in CO_2 emissions.

By realizing more uniform temperature distribution over a wider area than conventional oxy-enriched combustion burners, Innova-Jet® Swing technology promises to help save energy and cut CO_2 emissions in a range of potential applications in sectors such as steel, glass and ceramics manufacturing.