



Contribution ID: 51

Type: **Poster Presentation**

SMS ZERO2Flame HY2 burner for reheating furnaces

Tuesday 7 October 2025 19:03 (1 minute)

R&D in SMS Group focused on the study and testing of an innovative lateral burner for reheating furnaces, able to work in flame and flameless mode, with hydrogen content in the natural gas-H₂ fuel blend up to 100%vol. H₂, and oxygen (O₂) content in the comburent flow up to 50%vol. O₂. An intensive CFD simulation campaign was conducted, with the aim of defining an optimized burner design, able to work efficiently in all the mentioned conditions. In flame mode, the oxygen addition led to a reduction of the combustion-reaction zone, a detached flame and a strong temperature gradient in the flame, with increasing trend of the maximum temperature of the flame, due to the increase of the gases reactivity. The OH- radicals concentration exhibited an increase, in agreement with the high NO_x values. The results in flameless regime manifested an opposite trend, with increasing the oxygen content in the comburent, with a decrease of the temperature values and an accentuated homogeneity in the heat release in the furnace chamber.

The experimental tests highlighted the predominant and opposite effects of oxygen and hydrogen contents, on the SMS ZERO2Flame HY2. In flame mode, NO_x emissions increased with the hydrogen and oxygen contents. The optimized burner design allowed to obtain extra-low NO_x emission results in flameless mode, below 80 mg/Nm³ at 3%vol. O₂ DFG in all the tested conditions. In “mild” regime both hydrogen and oxygen contents’ increase lead to a NO_x emission reduction, with a uniform heat release in the furnace chamber. The developed oxygen supply system granted an optimized fuel-comburent mixing, combining both the beneficial effects of the flameless combustion and the oxygen-enhanced combustion. SMS ZERO2Flame HY2 burner is a flexible solution for multi-fuel hydrogen-ready oxygen-enhanced requirements, able to offer extra-low pollutants production and an optimized heat release for reheating furnaces.

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Session Classification: Poster Session

Track Classification: Hydrogen-based Steelmaking