

Hydrogen for industrial high-temperature processes – Opportunities and challenges

Abstract

For high-temperature industrial processes ($T > 650$ °C), combustion is virtually the sole economically feasible means of achieving the required temperatures, at the requested heat input in MW or in required flue gas volume. Hydrogen is a logical candidate for a circular fuel for these processes. The same can be argued for large-scale processes where significant heat input is needed.

The use of Hydrogen as cyclic energy carrier for high-temperature processes poses several challenges. To be considered a clean fuel, an objective should be that combustion of Hydrogen yields similar or lower emission level values of NO_x than the natural gas it replaces. These features have consequences for both the development and the design of ultra-low NO_x industrial heat transfer equipment based on (co-)combustion of Hydrogen.

In overcoming the challenges to achieve ultra-low NO_x combustion of Hydrogen and of mixtures of natural gas and Hydrogen, it will be shown that the design rules for ultra-low NO_x heat transfer equipment need to be adapted with respect to those developed for natural gas or other high-calorific gaseous fossil fuels. Also, the challenges in turbulent combustion modeling for this specific purpose will be discussed.

About Mateq Process

Mateq Process is dedicated to facilitate the energy transition for high-temperature industrial processes.

Mateq Process is offering solutions in the range of process design of heat transfer equipment with an emphasis on the use of CFD as main tool. Its focus is on the process design; with extensive knowledge and know-how of flow, combustion and heat transfer in industrial process equipment. These are for instance steam- and hot water boilers, furnaces, direct fired heat exchangers, and include gas turbine exhaust ducts, heat recovery steam generators, ducting, etc.

Services include product design analysis, development and optimization, but also root-cause analysis and mitigation investigations, scale effects and effects of a switch to green(er) fuels.

Extensive practical experience is combined with years of expertise in Computational Fluid Dynamics (CFD), and a thorough knowledge of the underlying processes, that has been collected over the past 20 years.

For more information, see our web page www.mateqprocess.com.