## POLLUTION ASPECTS

# (623) - (*) - MODELLING OF NEW LOW-NOX TECHNOLOGIES IN INDUSTRIAL BURNER APPLICATIONS USING THE REACTOR NETWORK MODEL


Virginia Fratalocchi (United Kingdom)[1]; Michael Pichler (Austria)[2]; Stefan Riebenbauer (Austria)[3]

1 - Siemens Digital Industries Software; 2 - DUMAG GmbH; 3 - ACAM Engineering GmbH


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The power generation and process industries account for over one-third of the global total primary energy demand. The main source of this energy is still represented by combustion of fossil fuels. Combustion processes are responsible for over 95% of several pollutants (ie. CO2, SO2 and NOx), for which, due to increasing awareness and concern for the world's climate future, constantly increasing restrictive emission regulations are legislated. As NOx is one of the most harmful emissions from combustion, the development of technologies that lower its emission is of paramount importance for industrial combustion applications. Aside from secondary measures for NOx- removal, measures like using new fuels, changing the layout of a design and adapting operational conditions to new strategies, significantly influence the formation process of NOx. DUMAG is one of the technology leaders in these so- called "primary measures" and develops specialized products in this field for decades. However, it is not feasible to carry out all the necessary tests prior the execution of the system. CFD (Computational Fluid Dynamics) modelling provides reliable results without the need to scale the actual model, thus it allows to improve the overall system performance while reducing the turnaround costs and shorten the time to market. This paper presents the numerical investigation of an industrial low NOx burner by DUMAG. The analysis was performed with Simcenter STAR-CCM+, while the experiments were carried out at the Technical University of Graz by DUMAG in collaboration with the Institute of Thermal Engineering. In this work, a traditional Multi Fuel Burner low NOx (MFBX) was investigated, as well as a new concept of "Super LowNOx" technology that uses high performance staging strategies of fuel and air to lower the emissions. In particular, the results of composition of exhaust gases, wall temperatures and emissions were examined and compared to experimental data. The modelled flames showed a similar shape to the images that were captured inside the furnace as well as the recirculating flow patterns produced by the LowNOx Burners. A robust and automated methodology within a single simulation framework was adopted to accurately predict three different operating conditions. For each configuration, a RANS simulation was performed and the combustion was treated with the Flamelet Generated Manifold. The obtained CFD solution was then used to generate the network of reactors by enabling the automated Reactor Network model. A sensitivity analysis of the key parameters of the Reactor Network model such as clustering variables and number of reactors, was performed to assess the influence on the resulting flow field. The CFD and RN framework used in Simcenter STAR-CCM+ was able to accurately predict emissions, while leveraging the faster turnaround time of the flamelet model compared to the complex chemistry CFD.



**Palavras-chave : low-NOx, burner, CFD, Reactor network, Simcenter STAR-CCM+**