K1-MET

Competence Center for Excellent Technologies in Advanced Metallurgical and Environmental Process Development

Main location	Linz, Upper Austria
Other locations	Leoben, Styria
Thematic field	K1-MET has its focus on the modeling and simulation of metallurgical processes, including metallurgical raw materials and refractories with the goal of an optimal process control with respect to product quality, zero waste and the minimization of energy and raw materials.

Success story summary

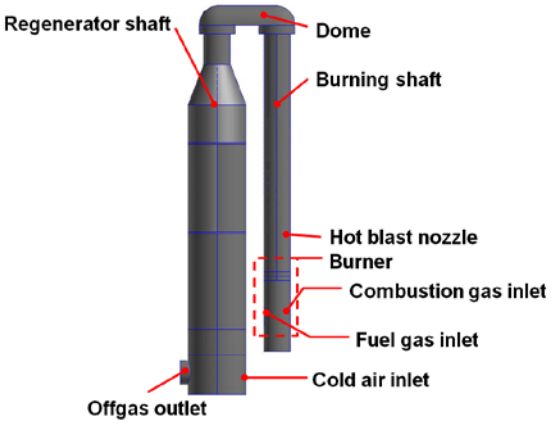
Pollution formation in a Blast Stove

The formation of NO and CO during the preheating of a blast stove at the voestalpine Stahl GmbH Linz was investigated by means of Computational Fluid Dynamics. The main goal of this study was the influence of operating conditions on the formation of NO and CO during a gas combustion. The obtained numerical results can be used to optimize the blast stove operation with regard to legal emission limits. A comparison between numerical results and real plant data showed promising agreement.

Success story

Blast stoves (also called cowpers) are essential auxiliary units of a blast furnace for preheating the air being necessary for raw iron production, which is called hot blast.

The figure on the right-hand side shows a schematic view of a blast stove. A stove consists of a burning shaft where combustion of Blast Furnace Gas (enriched with e.g. natural gas) takes place. The hot combustion gases pass the dome and enter the regenerator shaft, which consists of a plurality of refractory bricks equipped with vertical gas channels. The bricks store the gas heat, which is subsequently used for the hot blast preheating. During gas combustion pollutants such as nitrogen oxides (NO_X) and carbon monoxide (CO) are formed. NO_X especially nitrogen monoxide NO has beside its greenhouse gas effect a corrosive potential representing under certain conditions the starting point of severe stress corrosion cracking of the blast stove steel shell.



The formation of NO and CO during the blast stove preheating process in dependence on the operating conditions (gas flow rates and temperatures, air excess) was modeled by means of Computational Fluid Dynamics. The nuermical simulations considered turbulence of flow (high Reynolds numbers in the gas inflow area), heat exchange between gas and stove walls by means of radiation and the pollution formation during gas combustion respectively. The calculated results were compared with real plant data and showed promising agreement.

Impact and effects

The numerical results can be used by blast furnace operators for optimization of hot blast production efficiency with respect to legal NO and CO emission limits.

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