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Replacement of Conventional Gas Burners with Electrical Resistive Heating for Tundish processes: A Sustainable Approach within the CITADEL Project

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The transition to sustainable steel production is a critical challenge in reducing the environmental impact of high-temperature metallurgical processes. While basic oxygen route steelworks are nowadays focused on the development of new production processes for decarbonization of the iron reduction, the Electric Arc Furnace (EAF) route producers have the potential to eliminate almost all their CO₂ emissions by using renewable electric power and green hydrogen in their existing production facilities.

One significant area for improvement is the tundish pre-heating process, traditionally reliant on fossil fuel-based burners, that contribute to CO₂ emissions and inefficiencies. The present study, conducted within the framework of the Horizon-funded CITADEL project, explores the feasibility of replacing conventional gas burners with an electrical tundish pre-heating system, aiming to enhance energy efficiency and reduce the environmental footprint of continuous casting operations.

A numerical model was developed to simulate heat transfer dynamics and temperature distribution within the tundish. Modelling results indicate that electrical tundish pre-heating has the potential to provide a more uniform heating profile, reduce energy consumption, and eliminate combustion-related emissions. Ongoing work includes the design and implementation of experimental trials to validate these findings under industrial conditions. Future experimental investigations will assess key performance indicators such as temperature homogeneity, refractory wear, and overall process stability.

The results of this study align with the objectives of the CITADEL project, which focuses on advancing low-carbon solutions for the steel industry. By demonstrating the potential of electrical tundish heating, this research supports the broader adoption of electrification strategies, contributing to the decarbonization of steel-making and the achievement of EU climate targets.

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