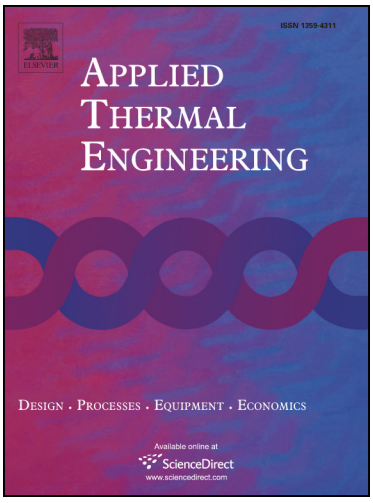

Comparison between solid body and gas radiation in high temperature furnaces under different oxygen enrichments

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Comparison between solid body and gas radiation in high temperature furnaces under different oxygen enrichments

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Abstract

Up to now, the heat flux to a load in a reheating furnace has been subdivided, at most, into two parts: a convective part and a radiative part, which is a combination of solid body and gas radiation. This study presents a novel method to distinguish between solid body radiation and gas radiation within the radiative part of the heat flux. The method is computationally efficient and can be performed in a short period of time. The method was used to investigate two furnaces: a 115 kW lab-scale furnace and an 18 MW industrial reheating furnace, using oxidizers with different oxygen concentrations. The CFD results of the lab-scale furnace were compared to measurements and showed good agreement. Both simulation and the experiment showed that the furnace efficiency increased with increasing oxygen concentrations in the oxidizer. For both furnaces, the investigation revealed that the radiation emitted by the walls was by far the largest contributor to the total heat flux, while the contribution of gas radiation was minor. This method can be used to optimize the design of reheating furnaces in the future.

Keywords:
Computational Fluid Dynamics, Solid body radiation, Gas radiation, High temperature furnace, Reheating furnace

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