

Scale-Adaptive Simulation on the Reactive Turbulent Flow In A Partial Combustion Lance: Assessment of Thermal Insulators

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ABSTRACT

This paper presents a scale-adaptive simulation (SAS) of a partial combustion lance (PCL) aiming to evaluate the influence of thermal insulation on the performance of syngas combustion. Standard $k-\epsilon$ (SKE) and Reynolds stress model (RSM) were used for comparison. The combustion reaction was modelled using eddy dissipation model (EDM), non-premixed and partially premixed flame models. Discrete ordinates (DO) and spherical harmonics (P-1) were used to calculate the radiative heat transfer. The finding suggests that SAS provides a better prediction for reactive turbulent flow. In the present work, simulation of syngas combustion using non-premixed flame with a DO approach showed the best agreement with experimental data by about 5.3%. Installation of an insulator increases the peak outlet temperature by about 20.4%.

KEYWORDS: CFD; SAS; Combustion; Turbulence; Radiation; Insulation

DOI: [10.1016/j.applthermaleng.2016.03.165](https://doi.org/10.1016/j.applthermaleng.2016.03.165)