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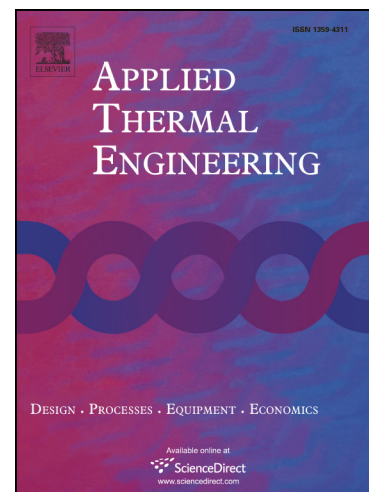
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Simulation of Flow field and Carbon Monoxide Emission in an Industrial Scale Heat Recovery Steam Generator

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Abstract

Computational simulation is performed for flow field and carbon monoxide (CO) emission in an industrial scale heat recovery steam generator (HRSG) by ANSYS Fluent v13. The geometrical details are reproduced with burner holes and swirler blades simplified to avoid excessive computational burden. Turbulence-chemistry interaction is modeled by the steady laminar flamelet model (SLFM) and the unsteady laminar flamelet model (ULFM) through a lookup table without time consuming integration of stiff elementary reaction steps. The ULFM showed good agreement with measured CO mass fractions near the extinction limit for Sandia Flame D in Turbulent Nonpremixed Flame (TNF) Workshop. The proper trends of variation and the same order of magnitude of CO mass fractions were reproduced by the ULFM for the three reference cases of varying HRSG loads. Parametric investigations were performed to identify the factors influencing exhaust CO with respect to the number and layout of activated burners and flow correction device (FCD). Results showed two competing factors for CO emission, rich mixture by undermixing and lean mixture by overmixing, which may lead to local extinction below the flammability limit.

Keywords Heat Recovery Steam Generator; Steady Laminar Flamelet Model; Carbon monoxide; Incomplete combustion

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