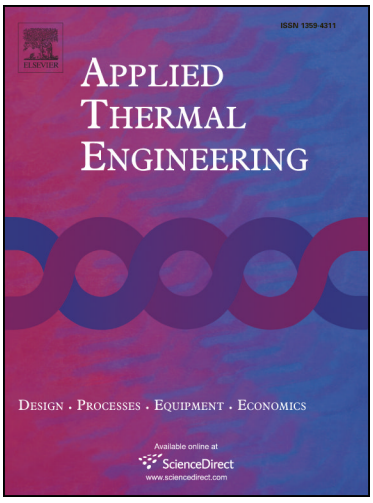

Research Paper

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Woojoo Han, Youngjae Lee, Jihoon Jang, Kang Y. Huh

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

Woojoo Han[a], Youngjae Lee[b], Jihoon Jang[c], Kang Y. Huh[a]*

[a] Department of Mechanical Engineering, Pohang University of Science and Technology, Pohang, Gyungbuk 37673, Republic of Korea

[b] Korea Institute of Industrial Technology, Chungnam, 31056, Republic of Korea

[c] KEPCO Research Institute, Daejeon, 34056, Republic of Korea

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*