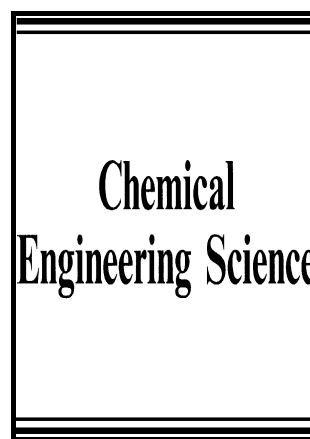


## Author's Accepted Manuscript

Numerical analysis of gasification and emission characteristics of a two-stage entrained flow gasifier

Bo Zhang, Zhuyin Ren, Shaoping Shi, Shu Yan, Fang Fang



[www.elsevier.com/locate/ces](http://www.elsevier.com/locate/ces)

PII: S0009-2509(16)30317-7  
DOI: <http://dx.doi.org/10.1016/j.ces.2016.06.021>  
Reference: CES13001

To appear in: *Chemical Engineering Science*

Received date: 14 January 2016  
Revised date: 5 June 2016  
Accepted date: 8 June 2016

Cite this article as: Bo Zhang, Zhuyin Ren, Shaoping Shi, Shu Yan and Fang Fang, Numerical analysis of gasification and emission characteristics of a two stage entrained flow gasifier, *Chemical Engineering Science* <http://dx.doi.org/10.1016/j.ces.2016.06.021>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and a review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain

# Numerical Analysis of Gasification and Emission Characteristics of a Two-Stage Entrained Flow Gasifier

Bo Zhang<sup>1</sup>, Zhuyin Ren<sup>2</sup>, Shaoping Shi<sup>1</sup>, Shu Yan<sup>1</sup>, Fang Fang<sup>1</sup>

1. Huaneng Clean Energy Research Institute, P. R. China, 102209

2. Center for Combustion Energy and School of Aerospace Engineering, Tsinghua University, P. R. China, 100084

## Abstract

A two-stage dry-feed oxygen-blown entrained flow gasifier of HNCERI (Huaneng Clean Energy Research Institute) has been numerically studied through an integrated CFD-ROM approach, in which computational fluid dynamics (CFD) simulation is employed to investigate the detailed flow, temperature and composition fields, as well as to provide necessary information for the construction of reactor network-based reduced order model (ROM). A ten-step gasification chemistry together with an eight-step pollutant formation model optimized for the HNCERI gasifier have been constructed to investigate the gasification characteristics and emission of  $\text{NO}_x$ ,  $\text{NH}_3$ ,  $\text{HCN}$ ,  $\text{COS}$ ,  $\text{SO}_2$  etc. Computational results show that a ROM consisting of two perfectly stirred reactors and one plug flow reactor can accurately reproduce the available gasification and emission industrial data in minutes on a PC and thus is suitable to integrate with process flowsheet simulation. Heterogeneous reactions are found to dominate the gasification process in the second stage of the gasifier. The  $\text{CO}/\text{H}_2$  distribution in product syngas is determined by the water gas shift reaction at the downstream of the second stage where it reaches equilibrium. A sensitivity analysis shows that the coal and oxygen feed rates have pronounced effects on gasification characteristics while the effects of the steam feed rate and pressure are minimal. In addition, the decrease in the ratio of the coal feed rate of the second stage to the total coal feed rate may further increase the gasification efficiency, the effective gas production rate and carbon conversion with slight decrease in the temperature within the gasifier.

Keywords: coal gasification; numerical simulation; reduced order model; CFD

Download English Version:

<https://daneshyari.com/en/article/6589019>

Download Persian Version:

<https://daneshyari.com/article/6589019>

[Daneshyari.com](https://daneshyari.com)