中国化学工程学报 2004 12 (3): 363-371 ISSN: 1004-9354 CN: 44-1863/R

REACTION KINETICS, CATALYSIS AND.....

二元催化器冷起动排放的数值模拟- 数学模型与结果分析

吴国江, 黄震, 陈晓玲

School of Mechanial Engineering, Shanghai Jiaotong University, Shanghai 200240, China

收稿日期 修回日期 网络版发布日期 接受日期

摘要 This paper integrated a two-dimensional axisymmetrical transient model applicable to cold-start emission applications. The model can be used to simulate and explain effects of the flow and temperature distribution on performance of a converter. The evolutions of distribution of the temperature and concentration in the monolith during the cold-start period and the effects of flow distribution in the monolith on the cold-start performance are simulated in terms of the integrated model. The investigation indicates that the axial and radial gradients of temperature of the solid become steeper as the inletgas temperature ramp increases; this furthermore results in the movement of reaction region in the monolith, and the flow distribution in the monolith affects the radial distribution of temperature of the solid;the radial gradients of temperature of the solid become greater as the flow uniformity indexdecreases, whereas the light-off time doesn't always increase as the flow uniformity index decreases. The analyses on the distribution of temperature and concentration in the monolith show that the catalytic reaction zone concentrates in central area near the front face. The predicted curves of the velocity distribution have a good agreement with the experimental data.

关键词 数学模型、排气净化器、冷启动、CSA 汽车

分类号

DOI:

Numerical Simulation of Cold-Start Emission for the Three-Way Catalytic Converter: Mathematical Model and Result Analysis

WU Guojiang, HUANG Zhen, CHEN Xiaoling

School of Mechanial Engineering, Shanghai Jiaotong University, Shanghai 200240, China

Received Revised Online Accepted

Abstract This paper integrated a two-dimensional axisymmetrical transient model applicable to cold-start emission applications. The model can be used to simulate and explain effects of the flow and temperature distribution on performance of a converter. The evolutions of distribution of the temperature and concentration in the monolith during the cold-start period and the effects of flow distribution in the monolith on the cold-start performance are simulated in terms of the integrated model. The investigation indicates that the axial and radial gradients of temperature of the solid become steeper as the inlet gas temperature ramp increases; this furthermore results in the movement of reaction region in the monolith, and the flow distribution in the monolith affects the radial distribution of temperature of the solid;the radial gradients of temperature of the solid become greater as the flow uniformity indexdecreases, whereas the light-off time doesn't always increase as the flow uniformity index decreases. The analyses on the distribution of temperature and concentration in the monolith show that the catalytic reaction zone concentrates in central area near the front face. The predicted curves of the velocity distribution have a good agreement with the experimental data.

Key words cold-start; numerical simulation; model; catalytic converter; emission; flow distribution

通讯作者:

吴国江 wugj@sjtu.net

作者个人主页: 吴国江; 黄震; 陈晓玲