

工程热物理

不同气化介质下CaSO4载氧体的煤化学链燃烧实验研究

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摘要: 采用流化床反应器并以CaSO4为载氧体, 研究不同CO2-水蒸气气化介质条件下燃料反应器内煤化学链燃烧反应特性。实验结果表明: 在950℃下, 不同CO2/水蒸气体积配比气化介质下燃料反应器出口气体产物均无H2、CH4; 随着CO2/水蒸气体积比的增大, 煤气化-CaSO4还原反应速率下降, CO累积率单调递增, CO2捕集效率单调递减; CO2/水蒸气体积比1:3时SO2累积量出现最大值; CO生成率随时间呈单峰特性, 而SO2生成量显现出多拐点与不对称的特性; 在30 min内煤-水蒸气、煤-CO2气化的碳转化效率分别为94.4%、92.5%, 而与之对应的燃料反应器内CO2捕集效率为95.8%、62.0%。

关键词: 化学链燃烧 CaSO4载氧体 CO2分离 SO2排放

Experimental Study on the Effect of Gasification Medium on Chemical Looping Combustion of Coal With CaSO4 Oxygen Carrier

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Abstract: The effect of CO2/steam gasification medium on chemical looping combustion (CLC) of coal with CaSO4 oxygen carrier was investigated experimentally in a fluidized bed as a fuel reactor, coal gasification and CaSO4 reduction with the syngas took on simultaneously in the fluidized bed. The results show that neither CH4 nor H2 exists in the flue gas at 950℃. CO accumulation rate increases monotonously with an increase of CO2/steam volume ratio, and the efficiency of carbon conversion to CO2 decreases. There is a maximum of SO2 accumulation amount at the CO2/steam volume ratio 1:3. CO generation rate in the flue gas presents a parabolic curve as a function of reaction time, while SO2 generation amount presents a multi-flexion and asymmetry curve. In the process of coal gasification, carbon conversion efficiency in 30 min reaches 94.4% with steam as a gasification medium, and 92.5% with CO2 as a gasification medium. However, in the corresponding process of coal gasification and CaSO4 reduction with the syngas the efficiency of carbon conversion to CO2 reaches 91.0% and 57.1%, respectively.

Keywords: chemical looping combustion CaSO4 oxygen carrier CO2 separation SO2 release

收稿日期 2008-10-13 修回日期 2008-12-29 网络版发布日期 2009-09-23

DOI:

基金项目:

国家自然科学基金项目(20590367, 90610016); 国家重点基础研究专项经费项目(2006CB20030201, 2006CB705806); 国家高技术研究发展计划项目(863计划)(2006AA05Z318)。

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