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能源和环境工程

Ni载体整体煤气化链式燃烧联合循环性能

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摘要 本文将具有分离CO_2的链式燃烧技术与整体煤气化联合循环(IGCC)技术结合，构成整体煤气化链式燃烧联合循环系统，对系统性能进行了模拟研究。结果表明，采用德士古气化工艺、空气反应器出口温度1200℃，$NiO/NiAl_2O_4$作载氧体，压气机压比17、补燃后透平初温(TIT)1350℃、冷却空气量12%时，系统净效率39.61% HHV（41.55%LHV），CO_2排放量126 g·kW^{-1}·h^{-1}。补燃温度1350℃，空气反应器温度由1000℃升高到1200℃，CO_2的回收率提高约23%，系统效率由40.3%降低到39.61%；补燃温度由1200℃提高到1500℃，系统净效率由37.4%增加到40.8%，CO_2的排放量从3g·kW^{-1}·h^{-1}增加到202 g·kW^{-1}·h^{-1}；补燃温度一定，压比增大，系统比功减小，CO_2排放量增加，效率先增大后减小，存在最佳压比.

关键词 化学链燃烧 联合循环 CO_2分离

分类号

Performance investigation of Ni-based CLC gasification combined cycle

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Abstract

Chemical looping combustion (CLC) offers a possibility of separating the greenhouse gas CO_2.An integrated gasification combined cycle based on CLC is discussed in this paper.In the system,$NiO/NiAl_2O_4$ is used as the CLC oxygen carrier and Texaco gasification process is selected.The system performance is simulated by using ASPEN software tool.The system efficiency is 39.61%HHV (41.55%LHV) and CO_2 emission is 126 g·kW^{-1}·h^{-1} , assuming compressor pressure ratio 17, air reactor outlet temperature 1200℃, turbine inlet temperature (TIT) 1350℃ after supplementary firing, and cooling air fraction 12%.At TIT 1350℃, CO_2 capture rate increases by about 23% and system efficiency decreases from 40.3% to 39.61% when the air reactor outlet temperature rises from 1000℃ to 1200℃.With the increase of TIT after supplementary firing from 1200℃ to 1500℃, system efficiency increases from 37.4% to 40.8% and CO_2 emission rises from 3 g·kW^{-1}·h^{-1} to 202 g·kW^{-1}·h^{1}.At a specific TIT there exits an optimum pressure ratio and the optimum pressure ratio goes up as TIT rises.

Key words

chemical looping combustion combined cycle CO_2 separation

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