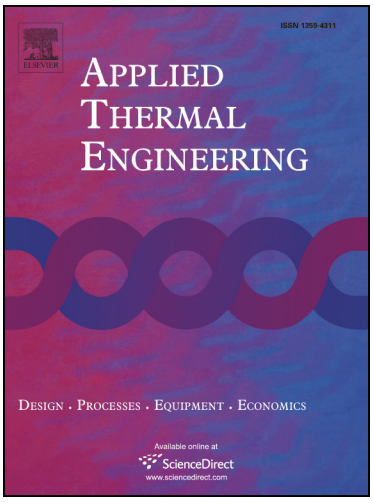

300 MW Boiler Design Study for Coal-fired Supercritical CO_2 Brayton Cycle

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300 MW Boiler Design Study for Coal-fired Supercritical CO_2 Brayton Cycle

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Abstract: Supercritical CO_2 (S-CO_2) Brayton power cycle has been considered as a promising alternative choice of conventional steam cycle for coal-fired power plants. A conceptual design of the boiler is conducted for a 300 MW single reheated recompression S-CO_2 Brayton cycle for coal-fired power plant with turbine inlet parameters of 32 MPa/600 ^{o}C/620 ^{o}C. The conventional economizer (ECO) is replaced with the split heater (SH) to reduce the inlet temperature of cooling wall of the furnace as well as to recover the flue gas heat The technology adaption of S-CO_2 power cycle for coal-fired power plant has been evaluated in terms of specific design of the 300MW coal fired boiler as well as the whole thermodynamic cycle layout. The boiler design and off-design thermal calculation results show that the S-CO_2 boiler proposed in this paper can match well with the entire coal-fired S-CO_2 Brayton cycle power generation system and has a good boiler variation performance.

Keywords: S-CO_2 boiler; Brayton cycle; conceptual design; heat transfer

1. Introduction

Coal is expected to remain the main fuel source of power generation for a long time in the world[1,2]. Unfortunately, air pollution and global warming problems caused by SO_2, NO_x, CO_2 and dust emission from coal combustion should be seriously addressed [2-4]. Thus, it is of great importance to increase energy conversion efficiency and in turn to reduce the fuel consumption and air pollutants emission.

Up to now, steam Rankine cycle has dominated absolutely in coal power plants to convert thermal energy to electricity. However, it is very difficult to improve the power conversion efficiency further, as it is a great challenge to increase the turbine inlet steam temperature up to

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