Int J Coal Sci Technol (2021) 8(3):325–326
https://doi.org/10.1007/s40789-021-00454-0

Special issue on integrated gasification fuel cell (IGFC) technology

Suping Peng[1]

Accepted: 2 July 2021 / Published online: 17 July 2021

Coal is the primary fossil fuel used globally for electricity generation and chemical products for a long time. However, utilization of coal also results in emissions of CO_2 and other pollutants. At present, global climate change due to greenhouse gases, especially CO_2, is becoming more and more serious. It is necessary to improve the efficiency of coal power generation and achieve nearly zero CO_2 emissions.

Integrated gasification fuel cell (IGFC) systems that combine coal gasification and high-temperature fuel cells, such as Solid Oxide Fuel Cell (SOFC) or Molten Carbonate Fuel Cell (MCFC), are promising technologies because higher power generation efficiency and environmentally friendly is expected that of conventional coal-fired power generation systems.

The goal of the issue is to introduce the progress and prospects of advanced IGFC technology and analyze the efficiency and economic performance of the IGFC plant with CO_2 capture. This issue also reviews recent advances in basic research and technological development on the processes of coal gasification and purification technology, SOFC technology and MCFC technology, carbon capture, utilization, and storage technology (CCUS), Solid Oxide Electrolysis Cell (SOEC) technology.

From the perspective of IGFC and IGFC technologies in China (Peng et al. 2021), the development of new technology for coal gasification purification and research on the formation mechanism of pollutants are presented (Zheng et al. 2021). Meanwhile, the effect of alkali metal ions on the formation mechanism of HCN during pyridine pyrolysis is researched (Liu et al. 2021).

The critical fuel cell technology about the performance test on a 5 kW SOFC system under high fuel utility with practical syngas feeding(Xu et al. 2021), the operating parameters of the 10 kW SOFC-CHP system with syngas (Li et al. 2021), and 10 kW molten carbonate fuel cell power generation systems are introduced (Lu et al. 2021). In addition, the fabrication and performance of atmospheric plasma sprayed solid oxide fuel cells with liquid antimony anodes are researched (Jiang et al. 2021).

Based on this, key CO_2 capture technology for pure oxygen exhaust gas combustion by syngas-fueled high-temperature fuel cells (Wang et al. 2021) and CO_2 utilization technology by SOEC technology (Yang et al. 2021) are discussed.

Finally, the status update of the IGFC power generation system being developed at the National Institute of Clean-and-Low-Carbon (NICE) at the MW_{th} scale is provided (Wei et al. 2021).

All the studies presented in the Special Issue cover both the development of IGFC technologies and the key result of the IGFC project.

✉ Suping Peng
psp@chinacs.org.cn

[1] Research Center of Solid Oxide Fuel Cell, State Key Laboratory of Coal Resource and Safety Mining, China University of Mining and Technology-Beijing, Beijing 100083, China

References

Jiang YD, Mo WF, Cao TY, Shi YX, Cai NS (2021) Fabrication and performance of atmospheric plasma sprayed solid oxide fuel cells with liquid antimony anodes. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00430-8

Li B, Lyu ZW, Zhu JZ, Han MF, Sun ZH (2021) Study on the operating parameters of the 10 kW SOFC-CHP system with syngas. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00451-3

Liu J, Zhao W, Fan XR, Xu MX, Zheng S, Lu Q (2021) Effect of alkali metal ions on the formation mechanism of HCN during pyridine pyrolysis. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00427-3

Lu CZ, Zhang RY, Yang GJ, Huang H, Cheng J, Xu SS (2021) Study and performance test of 10 kW molten carbonate fuel cell power generation system. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00442-4

Peng SP (2021) Current status of national integrated gasification fuel cell projects in China. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00443-3

Wang HL, Lei QL, Li PP, Liu CL, Xue YP, Zhang XW, Li CF, Yang ZB (2021) Key CO_2 capture technology of pure oxygen exhaust gas combustion for syngas-fueled high-temperature fuel cells. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00445-1

Wei C, Liu ZE, Li CF, Singh Surinder LuHR, Gong YD, Li PP, Wang HL, Yang X, Xu M, Mu SJ (2021) Status of an MWth integrated gasification fuel cell power-generation system in China. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00429-1

Xu M, Wang HL, Liu MX, Zhao JN, Zhang YQ, Li PP, Shi ML, Gong SQ, Zhang ZH, Li CF (2021) Performance test of a 5 kW solid oxide fuel cell system under high fuel utilization with industrial fuel gas feeding. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00428-2

Yang ZB, Lei Z, Ge B, Xiong XY, Jin YQ, Jiao K, Chen FL, Peng SP (2021) Development of catalytic combustion and CO_2 capture and conversion technology. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00444-2

Zheng S, Shi YX, Wang ZQ, Wang PJ, Liu G, Zhou HC (2021) Development of new technology for coal gasification purification and research on the formation mechanism of pollutants. Int J Coal Sci Technol. https://doi.org/10.1007/s40789-021-00420-w