One ASU Alternative: $O_2$-$CO_2$ Production for Oxyfuel Combustion Using Chemical Looping Method

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Abstract

As one promising option for CCS, oxyfuel combustion is developed and demonstrated around the world. But the significantly high investment cost and energy consumption of ASU is one challenge to the promotion of oxyfuel combustion. The atmosphere in oxyfuel boiler is $O_2$-$CO_2$ mixed stream with 20~30% $O_2$ concentration, which is mixed by recycled $CO_2$ and pure oxygen produced by ASU. So it is possible to reduce the cost of ASU by produce the $O_2$-$CO_2$ mixture directly using chemical looping method. The Co-based and Cu-based oxygen carriers are applicable in this system and the two kinds of oxygen carriers made by impregnation were studied on TGA and fluidized bed. According to the experiment results, the Co-based oxygen carrier showed high reaction characteristics and stability, and a continuous stream of oxygen-enriched carbon dioxide with oxygen concentration higher than 20% is produced in two parallel fixed-bed reactors operated in a cyclic manner using Co-based oxygen carrier. Comparing with Co-based oxygen carrier, the Cu-based oxygen carrier was more economically feasible, but it had a sintering problem at high temperatures which lead to a rapid decline of reaction ability, so several modification methods were researched to develop the reaction stability of Cu-based oxygen carrier. Both of the Co-based and Cu-based oxygen carriers showed potential for applications as an alternative of ASU for oxyfuel combustion.

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