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Chemical looping process: An alternative approach to address green-house problems

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Chemical Looping Combustion (CLC) process has been under intense research as it captures 100% CO_2 and is environmental friendly. The use of hydrogen, the fuel of the future for power production using CLC process certainly enhances the thermal efficiency of the power generation plant. The production of hydrogen by Chemical Looping Reforming (CLR) technology is an innovative process that consents carbon capture and storage effectively. A Computational Fluid Dynamics (CFD) model has been developed for the steam reactor of CLR process is based on the kinetic theory of granular flow. An Eulerian multiphase treatment is used to describe the continuum principle of two fluid model for both gas and solid phase model. In the present work, different metal oxides (FeO and MnO) are used as oxygen carrier with steam as fuel for the reaction kinetic model of the steam reactor. The bubble hydrodynamics and the relationship between molar fraction of products and gas phase and unsteady characteristics of bubble formation are numerically captured. The conversion rate of steam has been analyzed for different granular sizes and the overall performance of a CLR system has been studied. The temporal development, rise, growth and burst of bubbles in the steam reactor are simulated for unsteady and quasi-steady behavior. The quasi-steady state also noticed to be achieved faster for finer particles than coarser ones that also ensures faster hydrogen production rate for the former case.

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