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A Phenomenological Approach to Designing Parallel Packed Bed Reactors for Gas Fuel Chemical Looping Combustion

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Abstract

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Optimizing the design and operation of parallel packed bed reactors for gas fuel CLC requires a multidisciplinary approach that considers reactor geometry, configuration, packing materials, operating conditions, and process integration strategies. Design parameters, such as bed height, diameter, packing density, particle size distribution, and gas flow rates, are systematically evaluated to maximize reactor performance while minimizing capital and operating costs.

A phenomenological approach to designing parallel packed bed reactors for gas fuel chemical looping combustion offers a systematic framework for understanding and optimizing reactor performance, with the potential to enhance energy efficiency, reduce greenhouse gas emissions, and promote sustainable development. By integrating fundamental principles of fluid dynamics, heat and mass transfer, chemical kinetics, and reactor engineering, researchers and engineers can advance the development and deployment of CLC technology towards a cleaner and more resilient energy future. the phenomenological approach presented herein offers a systematic framework for the design and optimization of parallel packed bed reactors for gas fuel chemical looping combustion (CLC). By integrating fundamental principles of fluid dynamics, heat and mass transfer, chemical kinetics, and reactor engineering, this approach enables engineers and researchers to develop efficient and sustainable CLC systems. Through the systematic analysis of flow distribution, heat and mass transfer phenomena, and chemical reaction kinetics, this approach facilitates the identification of optimal reactor configurations, operating conditions, and oxygen carrier materials. By optimizing