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C1Po1F-01: Performance Investigation of Gas-Solid Heat Transfer from Room to Cryogenic Temperatures in Moving Solid-Phase Cold Storage

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Liquid Air Energy Storage (LAES) is an emerging energy storage technology characterized by its high energy density and non-polluting nature. It stores surplus electricity through the processes of compression, cooling, and liquefaction of air, and releases electricity to compensate grid loads through the pressurization, gasification, and expansion of liquid air. The core process involves the storage of cold energy from air liquefaction and gasification. Due to the inherent safety and low material costs, solid-phase cold storage technology has been widely studied. Among these technologies, the fixed particle packed bed cold storage technology is most extensively researched, but it suffers from dynamic effects due to thermocline development during heat transfer, limiting efficiency improvements. Based on this research status, we propose a moving solid-phase cold storage process where the cold storage particles exchange heat with the carrier gas in a countercurrent flow and store the cold and heat particles separately. The movement of particles can mitigate the adverse effects of the thermocline, thereby enhancing heat transfer efficiency. In this study, we construct a model of the heat transfer process and investigate the matching characteristics of gas-solid phase velocities as well as the establishment of a steady-state heat transfer process.

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