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Numerical Modeling for the Reactive Process of Thermochemical Energy Storage Based on Lattice Boltzmann Method

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The energy storage technology is capable to fill the gap between energy demand and supply and make the renewable energy more efficient, which have also become the research emphasis recently. Among three existing energy storage techniques, thermochemical energy storage has the highest energy density and longest storage period. In this study, we constructed a two-dimensional numerical model of a CaO/Ca(OH)2 thermochemical energy storage reactor, using lattice Boltzmann method to calculate the whole process. This method is efficient and able to deal with complex boundaries. With regard to CaO/Ca(OH)2 energy storage process, it is based on the reaction of CaO with water vapor, which can be considered as heterogeneous gas-solid reaction. According to previous relevant researches, the model in this study consists of two parts, fluid area and solid area. The fluid (H2O) flows in from one side and out the other, which interacts with the solid particles (CaO), which is similar to previous model. A few reasonable assumptions were taken: the diffusion of fluid in solid phase was ignored; the gas-solid interface followed the first-order kinetics model; the heterogeneous reactions only happened at the interface. Besides, the solid update algorithm was adopted in order to describe the phenomenon that the mass and volume of solid changes during the reaction, which means the flow state also changes as the reaction goes. When the result reached steady state, the reaction stopped. Additionally, the heat emitted by the reaction was determined by the reaction condition of each solid node, so this study is composed of flow, mass and heat transfer problems. It can help researchers to learn about more mechanisms of CaO/Ca(OH)2 energy storage and find out better solutions of promoting the efficiency of thermochemical storage reactor, which has great significances.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

[1] 张婷, 郭照立, 柴振华, 施保昌. 钙基吸收剂吸收 CO2 过程的格子 Boltzmann 模拟 [J]. 化工学报,2012,63(S1):165-171.
[2]Kang Q, Lichtner P C, Zhang D. Lattice Boltzmann pore-scale model for multicomponent reactive transport in porous media[J]. Journal of Geophysical Research: Solid Earth, 2006, 111(B5).

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