

Cu修饰的Fe₂O₃/Al₂O₃氧载体的循环反应稳定性研究

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Reactivity and stability of Cu-decorated Fe₂O₃/Al₂O₃ oxygen carrier for chemical looping combustion

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摘要 采用冷冻干燥法制备了经Cu修饰(10%)的Fe₂O₃/Al₂O₃氧载体。利用热重分析仪分别在850、900和950 °C等温环境下,使氧载体交替接触还原气体和氧化气体,来模拟氧载体在化学链燃烧中的循环过程。结果表明,经Cu修饰的Fe₂O₃/Al₂O₃氧载体在850和900 °C下的等温循环过程中反应性能都很稳定,在950 °C时的循环反应前期有微量烧结,但在循环后期反应性能也很稳定。随着反应温度的升高,氧载体氧化速率增大,还原速率和载氧率先减小后增大。与未经修饰的Fe₂O₃/Al₂O₃氧载体相比较,在900 °C下作等温循环实验,经Cu修饰的Fe₂O₃/Al₂O₃氧载体具有较高的载氧能力和还原速率,但氧化速率较低;两者都具有较好的循环稳定性。

关键词: 化学链燃烧 氧载体 稳定性 Fe₂O₃ Cu

Abstract: The Fe₂O₃/Al₂O₃ oxygen carrier decorated with 10% Cu was prepared by freezing granulation method; its reactivity and stability for chemical looping combustion was investigated in a thermogravimetric analyzer by alternately exposing the oxygen carrier to reducing and oxidizing conditions to simulate the chemical looping combustion (CLC) process. The results indicated that the Cu-decorated Fe₂O₃/Al₂O₃ oxygen carrier exhibits a good stability during the isothermal redox cycles at 850 and 900 °C. Although the oxygen carrier is sintered slightly at the beginning of redox cycles at 950 °C, it is stable in the later cycles. With the increase of the reaction temperature, the oxidation rate of the oxygen carrier increases monotonously, while the oxygen transport capacity and reduction rate decrease first and then increase along with the temperature. Compared with the non-decorated Fe₂O₃/Al₂O₃ oxygen carrier, the Cu-decorated Fe₂O₃/Al₂O₃ oxygen carrier exhibits higher oxygen transport capacity and reduction rate, but lower oxidation rate at 900 °C; both of them has a good stability during the redox cycles.

Key words: chemical looping combustion oxygen carrier stability Fe₂O₃ Cu

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