

论文

焙烧温度对Fe-Mn基吸附剂中高温煤气脱硫性能的影响及其作用机理

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摘要:

对优选出的Fe/Mn摩尔比为7:3的7F3M系列复合氧化物吸附剂进行孔结构特性和活性组分形态的表征及其还原、硫化性能的考察, 主要研究焙烧温度对吸附剂比表面积、孔体积和活性组分存在形态及其含量的影响, 并与不同焙烧温度制得的吸附剂在不同空速和硫化温度下的脱硫行为进行关联。结果表明: 焙烧温度升高, 吸附剂比表面积和孔容逐渐增大, 600℃时达到最大值; 继续升高焙烧温度, 吸附剂表面会因烧结而使其比表面积和孔容急剧下降; 吸附剂的还原性随焙烧温度的升高而降低, 这直接影响吸附剂中活性组分铁和锰的存在形态; 吸附剂在脱硫反应过程中的活性组分也与其硫化反应的温度有关, 硫化温度越高, 铁锰各形态活性组分的化学反应能力越低, 吸附剂中Fe₃O₄的含量在硫化反应过程中起主要作用。600℃焙烧制得的7F3M600吸附剂在2000h⁻¹, 500℃下具有最佳的脱硫行为, 其脱硫效率高于99%的稳定运行时间大于30h, 硫容最大可达45.56gS/100g吸附剂。

关键词: 焙烧温度; 铁锰基吸附剂; 中高温煤气脱硫; TPR

Effect and mechanism analysis of calcination temperature on the sulfidation behaviors of iron manganese based sorbents in hot coal gas

Abstract:

The calcination temperature is one of the main operation parameters needed to be regulated during the process of preparing sorbents. The reduction and sulfidation behaviors of 7F3M series mixed metal oxides sorbents with Fe/Mn atomic ratio of 7:3 were investigated, and the properties of pore structure and the forms of active components were characterized in this paper. The effects of calcination temperature on the special surface area, pore volume, and the forms and amounts of active component of Fe Mn mixed oxides sorbent prepared were discussed. In addition, the relation between these effects and the capacities of sorbent removing H₂S from hot coal gas was also analyzed under the conditions of different space velocity and sulfidation temperature. The results show that the specific surface area and pore volume of sorbent increase with the increase of calcination temperature, and they reach a maximum value at 600℃. The sintering phenomenon on the surface of sorbent occurs when the calcination temperature continuously increases, which makes the specific surface area and pore volume of sorbent reduce sharply. The sulfidation temperature has a strong influence on the desulfurization capacity of sorbents through the reduction of sorbent and formation of Fe₃O₄ by H₂ and CO contained in sulfidation gas. The Fe₃O₄ in sorbent is the optimal active species for the desulfurization of sorbent in hot coal gas and its amount can be adjusted by the sulfidation temperature and calcination temperature. The 7F3M600 sorbent has the best sulfidation performances at 500℃ and the space velocity of 2000h⁻¹. The desulfurization rate of sorbent can reach over 99% and sustain for more than 30h, in which the sulphur capacity of sorbent is up to 45.56gS/100g sorbent.

Keywords: desulfurization; Fe-Mn based sorbent; hot coal gas; TPR

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