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## 论文

### 钾钠盐类对钙基CO<sub>2</sub>吸附剂循环碳酸化的影响

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#### 摘要:

钙基CO<sub>2</sub>吸附剂如石灰石在循环煅烧/碳酸化过程中随着循环次数的增加碳酸化转化率迅速衰减,这对CO<sub>2</sub>的捕捉极为不利。该文在常压煅烧/碳酸化反应器系统上研究KCl、K<sub>2</sub>CO<sub>3</sub>、NaCl和Na<sub>2</sub>CO<sub>3</sub>作为添加剂对CaCO<sub>3</sub>循环碳酸化特性的影响。结果表明,在初始循环时,钾钠盐类的添加造成CaCO<sub>3</sub>碳酸化转化率的明显衰减,但随着循环次数的增加,添加剂使CaCO<sub>3</sub>转化率下降缓慢,反而高于原CaCO<sub>3</sub>转化率。钾盐较钠盐对CaCO<sub>3</sub>循环捕捉CO<sub>2</sub>能力有更好的促进作用,钾/钠氯化物比钾/钠碳酸盐效果更好。在CaCO<sub>3</sub>中添加质量比为0.5%~0.6%的KCl,碳酸化温度在680~700℃时,吸附剂能取得最高的循环碳酸化转化率,经20次循环反应后转化率可达0.44,而在相同条件下原CaCO<sub>3</sub>转化率仅为0.21。KCl对CaCO<sub>3</sub>碳酸化的影响包括两方面。一方面,KCl虽然在初始循环时使CaCO<sub>3</sub>煅烧后的比表面积和比孔容减小,但在长期的循环中能够使它们保持稳定;另一方面,KCl能增加反应中碳酸化产物层的缺陷浓度,有可能增大未反应Ca离子通过产物层的扩散率。因此添加了KCl的CaCO<sub>3</sub>能够在长期煅烧/碳酸化循环中保持良好的碳酸化性能。

**关键词:** 钙基CO<sub>2</sub>吸附剂 碳酸化 煅烧 循环吸收CO<sub>2</sub>

### Effect of Potassium and Sodium Salts on Cyclic Carbonation of Calcium-based CO<sub>2</sub> Sorbent

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#### Abstract:

It is unfavorable to CO<sub>2</sub> capture that the carbonation conversion of calcium-based CO<sub>2</sub> sorbent decays sharply as the number of cycles increases during the calcination/carbonation process. The effects of KCl, K<sub>2</sub>CO<sub>3</sub>, NaCl and Na<sub>2</sub>CO<sub>3</sub> as the additive on cyclic carbonation characteristics of CaCO<sub>3</sub> were investigated in the atmospheric calcination/carbonation reactor system. The result shows that CaCO<sub>3</sub> doped with potassium or sodium salts exhibits a substantial decrease in carbonation conversion at initial couple of cycles; however, it displays a slow decay in conversion with number of cycles. The carbonation conversion of CaCO<sub>3</sub> doped with the additive is higher than that of original CaCO<sub>3</sub> after several cycles. Potassium salt has better effect than sodium salt on improving CO<sub>2</sub> cyclic capture capacity of CaCO<sub>3</sub>, similarly, potassium or sodium chloride shows better effect than potassium or sodium carbonate. CaCO<sub>3</sub> doped with 0.5%~0.6% of KCl shows the highest cyclic conversion at carbonation temperature of 680~700 °C, and it achieves a conversion of 0.44 after 20 cycles, while original CaCO<sub>3</sub> reaches a conversion of 0.21 at the same reaction conditions. The effect of KCl as the additive on carbonation of CaCO<sub>3</sub> includes two aspects. On the one hand, although KCl decreases specific surface area and pore volume of calcined CaCO<sub>3</sub> at initial cycles, it can maintain specific surface area and pore volume during multiple cycles; on the other hand, KCl increases the void defect concentration in CaCO<sub>3</sub> product layer and then the diffusivity of unreacted Ca ion is maybe increased in product layer. Therefore, CaCO<sub>3</sub> doped with KCl can maintain better carbonation performance during the long-term calcination/carbonation cycles.

**Keywords:** calcium-based CO<sub>2</sub> sorbent carbonation calcination cyclic CO<sub>2</sub> capture

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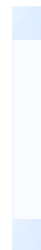
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