Surfactant assisted CaO-based sorbent synthesis and their application to high-temperature $\rm CO_2$ capture

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ABSTRACT

The concern of carbon dioxide (CO_2) emissions, a main contribution of greenhouse gases, has been emerged as an important issue for environmental impact. Adsorption of CO_2 by porous solid materials is proven to be one of efficient techniques for CO₂ capture technologies. In the present work, attempted has been made to improve property of porous solid materials, CaObased sorbent, applied for high-temperature CO₂ capture. CaCO₃ and CaO-based alumina was synthesized using precipitation technique with the addition of sulfonic single chain (SDS) and gemini (12-carbon hydrophobic chains and 3-carbon alkyl spacer, 12-3-12) surfactants for controlling/modifying physical properties. Our studies showed that the addition of anionic surfactants affected phase formation and polymorph of $CaCO_3$, where stronger effect was observed with gemini surfactant. The synthetic CaCO₃ was derived to form CaO and applied for capturing CO₂ at 600 °C, 15% v/v CO₂ (N₂ balanced). The results showed that CaO synthesized with adding gemini surfactant offered higher CO₂ sorption capacity than single chain surfactant. By incorporating calcium with alumina using co-precipitation technique, the addition of gemini surfactant showed a good impact on CO₂ capture performance as an increase in CO₂ sorption capacity was observed. However, sintering effect was still not yet be resolved with the addition of gemini surfactant as CO_2 sorption capacity decreased upon multiple cycles of CO_2 capture.

KEYWORDS:

CaCO₃; CaO-based sorbent; CO₂ sorption; SDS; Gemini surfactant