

Calcium-Based Reaction for the Separation of CO₂ Process (CaRS-CO₂ Process)

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Abstract

Economical management of carbon dioxide (CO₂) emissions is vital for the realization of a zero-emission Vision 21 power plant. It has been envisaged that the separation of CO₂ from flue gas (5-20% by volume) could cost 70-80% of the entire CO₂ sequestration process. OSU research has led to the development of a reaction-based process that offers dramatic improvements in sorption capacity and reactivity. Calcium oxide reacts with CO₂ in flue gas forming CaCO₃, which is then separated from flue gas and calcined to yield pure CO₂. Whereas CaO obtained from natural sources of limestone yield only 35 wt% capacity for CO₂, morphologically altered micron sized calcium oxide sorbent synthesized from OSU patented process provides 70 wt% capacity for CO₂ (compared to 1-10 wt% by adsorbents and absorbents typically used) under flue gas temperature and pressure. The sorbent has shown to retain its reactivity through 11 cycles. High efficiency calcination procedures have also been developed.

It is also imperative to produce larger particle size porous agglomerates that retain high reactivity, for the deployment of this process in existing fossil fuel combustion sources. Agglomerates ease the separation of calcium oxide sorbents from fly ash and enable the downstream calcination and re-injection. Current work is focused on pelletizing the sorbent for use in fixed-bed, fluidized bed, moving bed, entrained bed and monolith reactor configurations.