Regenerable Sorbents for CO_2 Capture from Moderate and High Temperature Gas Streams

Opportunity

The Department of Energy's National Energy Technology Laboratory (NETL) is seeking licensing partners interested in implementing United States Patent Number 7,314,847 entitled "Regenerable sorbents for CO_2 capture from moderate and high temperature gas streams."

Disclosed in this patent is NETL's process for making a granular sorbent to capture carbon dioxide from gas streams. The sorbent is made by homogeneously mixing a reactive substrate containing an alkali metal with an alkaline earth metal-containing moiety to form a mixture; adding water to the mixture; and drying the mixture. After drying, the sorbent is placed in a container permeable to a gas stream. The sorbents produced by this method absorb up to 38 times more gas than current methods.

Overview

The combustion of fossil fuels is one of the major sources of the greenhouse gas CO_2. The ability to efficiently and safely absorb CO_2 is important in the development and application of cost-effective technologies for CO_2 removal from gas streams. The costs of separation and capture of CO_2, including compression to the required CO_2 pressure for the sequestration step, are generally estimated to comprise about three-fourths of the total cost of ocean or geologic sequestration. Current CO_2 separation and capture methods lack the ability to be used at high temperatures and to be regenerated and used again.

NETL researchers have solved these challenges by inventing an inexpensive sorbent system with wide capabilities in warm- and hot-gas cleanup. The method involves homogeneously mixing an alkali metal oxide, alkali metal hydroxide, alkaline earth metal oxide, alkaline earth metal hydroxide, alkali titanate, alkali zirconate, alkali silicate and combinations thereof with a binder selected from the group consisting of sodium ortho silicate, calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$), alkali silicates, calcium aluminate, bentonite, inorganic clays and organic clays and combinations thereof. These sorbents are easily regenerated at higher temperatures and have very high CO_2 sorption capacities. They can sequester CO_2 at temperatures ranging from 25 °C to 500 °C, and be regenerated at temperatures ranging from 350 °C to 700 °C. Their mechanical and thermal stability render them robust for multiple sorption/regeneration cycles, thus reducing the cost of replacing sorbents frequently.

Significance

The sorbents covered by this patent are

- inexpensive
- thermally and mechanically stable to 700 °C
- able to be regenerated in situ
- capable of absorbing up to 38 times more CO_2 than current methods

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