Regenerable Immobilized Aminosilane Sorbents for Carbon Dioxide Capture

Opportunity

Research is currently active on the patent-pending technology titled "Regenerable Immobilized Aminosilane Sorbents for Carbon Dioxide Capture." The technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

Overview

Carbon sequestration entails a multi-step process in which CO_2 is first separated / captured from gas streams followed by permanent storage. Carbon capture represents a critical step in the process and accounts for a considerable portion of the overall cost. Newly developed, high capacity amine-based sorbents offer many advantages over existing technology including increased CO_2 capture capacity as well as reduced corrosion, energy requirement and cost, and water usage. Additionally, amine-based sorbents are scalable for use in industrial applications including coal combustion and gasification power generating systems.

This technology is an advancement on NETL's patent-pending "Regenerable Sorbent Technique for Capturing CO_2 Using Immobilized Amine Sorbents: the BIAS process" technology. Development of this second generation sorbent for the capture of carbon dioxide was based on the BIAS process steam requirements. This novel sorbent fabrication

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Patent Details

U.S. non-provisional patent application titled "Regenerable Immobilized Aminosilane Sorbents for Carbon Dioxide Capture" was filed on August 8, 2011.

Inventor: McMahan Gray

Significance

- Reduces energy loss during sorbent regeneration
- Allows for maximum CO_2 removal capacity
- Accounts for the role moisture plays in the overall sorbent process
- Minimizes the overall cost of CO_2 capture

Applications

Combustion or gasification power generation systems using amine-based solid sorbents used for CO_2 capture and natural gas cleanup.

Contact

NETL Technology Transfer Group
techtransfer@netl.doe.gov

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combines both chemical grafting and immobilization of the amine and the aminosilane into the high pore structure of the silica based substrate. In tests, the sorbent remained stable and resulted in significant carbon dioxide capture loadings.

Ultimately, the BIAS process method reduces the impact of water loading on sorbent regeneration by utilizing a conditioner following the steam regeneration step. The conditioner receives a flow of drying gas which contacts the regenerated sorbent to remove free steam, as well as reducing the water loading of the regenerated sorbent by removing a portion of the adsorbed water present. The adsorbed water removed by the conditioner is considerably equivalent to the water uptake expected to occur during the subsequent CO_2 absorption process. This provides for water loadings on the sorbent equivalent to the moisture loading of the regeneration process, allowing the thermal energy transferred to the loaded sorbent to be utilized for CO_2 desorption rather than desorption of adsorbed water. The method allows for optimization of the CO_2 removal capacity for a given absorption and regeneration reactor size. Management of water loading in this manner allows optimal regeneration reactor operation with a significant reduction in energy losses incurred by the necessary desorption of adsorbed water.