



Separation of CO₂ From Multi-Component Gas Streams

Opportunity

Research is active on the patent-pending technology, titled "Apparatus and Process for the Separation of Gases Using Supersonic Expansion and Oblique Shock Wave Compression." This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

Overview

The separation of a gaseous mixture into constituent gases has proven to be useful for a variety of industrial and commercial applications. Currently CO₂ can be separated from multi-component gas streams using compression and refrigeration techniques in order to condense the CO₂ out of a vapor phase so that it can be mechanically separated from the stream. These techniques require a significant amount of energy expenditure as well as additional system complexity.

This patent-pending invention addresses the above issues by applying two aerodynamic techniques that both cool the gas and change the phase of the CO₂ component from a vapor into a solid so that it may be mechanically separated from the stream.

The method first moderately pressurizes the multi-component gas stream to the point where it may be accelerated to a supersonic speed through a converging-diverging nozzle. This process cools the gas stream without refrigeration to the point where CO₂ changes phase from a vapor to a solid thereby eliminating the need for an energy-intensive compression and refrigeration cycle. After this expansion, the gas is in a supersonic state and is passed through a series of oblique shock waves. These shock waves gently increase the pressure and temperature of the mixture such that CO₂ remains in a solid state while the other components stay in a gas phase.

Since the invention has been shown to be useful to separate CO₂ from a multi-component gas stream, it has potential for future application in any fossil fuel burning power generation system where CO₂ gas is generated as a by-product.

Patent Details

U.S. Non-provisional Patent Application No. 13/208,784 was filed on August 8, 2011, titled "Apparatus and Process for the Separation of Gases Using Supersonic Expansion and Oblique Shock Wave Compression"

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Significance

- Provides a method for CO₂ separation from a mixed gas stream
- Uses two aerodynamic techniques to both cool and change the CO₂ phase
- Cooling of the gas stream occurs without refrigeration
- Method increases pressure to facilitate CO₂ removal

Applications

- Applies to any fossil fuel plant where CO₂ is a by-product

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