Columbia Technology Ventures

Carbon Dioxide Separation at High Temperatures with Ceramic Membrane

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Ceramic membrane separates carbon dioxide at high temperatures: Due to a growing concern over greenhouse gas emissions, the development of methods of separating carbon dioxide from gaseous process streams has gained importance. While there are carbon dioxide membranes for low temperatures, constructing membranes for operation at high temperatures reminds a challenge. High temperature ceramic membranes that selectively pass carbon dioxide would enable a number of novel technologies ranging from the design of zero-emission coal-based electric power plants with built-in carbon sequestration to ultra-efficient solid oxide fuel cells that oxidize a mixture of carbon dioxide and carbon monoxide which is held at an optimal concentration ratio.

Carbon dioxide removal with ceramic membrane for power plants and exhaust systems
This invention presents a method of separating carbon dioxide from mixture of gaseous molecules having temperature at 200-1200 degrees Celsius. The permeable membrane comprises regions formed from carbonate and oxygen conductive solid oxide, and a body allowing carbon dioxide to pass. The membrane being investigated is a composite material derived from a combination of molten carbonate and solid oxide electrolyte technologies. Further, the materials have been combined together into a composite membrane structure whereby the carbonate is infiltrated and immobilized into the pore space of a solid oxide material. By choosing materials appropriately, one can adjust the operational temperature range of the membrane. The new membranes can work at the high temperature of various known systems and processes and promise greatly improved efficiency.

Applications:
- Zero-emission coal-based electric power plants
- Exhaust systems for the removal of carbon dioxide
- Carbon dioxide capture in power plants
- Direct steam methane reforming
- Used in combination with solid oxide fuel cell
- Coal gasification
- Carbon chemistry

Advantages:
- Simple recovery of carbon dioxide in fuel gas streams
- Membrane in the form of disk, plate, cylinder, cube, tube, film, or sheet
- Adjustable operational temperatures ranging from 200 to 1200 degrees Celsius
- Efficient design
- Improved efficiency

Licensing Status: Available for Licensing and Sponsored Research Support


**Inventors**

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