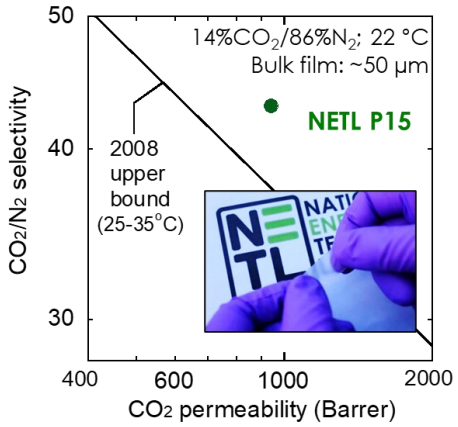
TECHBRIEF

NETL Ref. No: 23N-05

Blended Rubbery Polymer for Gas Separation

Opportunity



Gas separation properties of NETL's blended rubbery polymer membrane (green dot).

The U.S. Department of Energy's National Energy Technology Laboratory (NETL) has developed a method for creating advanced polymer membranes to efficiently separate carbon dioxide (CO_2) from nitrogen (N_2). These membranes combine excellent CO_2 permeability, selectivity and stability, even in humid conditions, making them ideal for industrial applications like CO_2 capture from flue gas. NETL's rubbery blend membrane resists aging and humidity and exceeds Robeson's 2008 upper bound for CO_2/N_2 separation. By exhibiting high CO_2 permeance (up to 4,500 GPU), moderate CO_2/N_2 selectivity (40) and long-term stability, it can efficiently separate CO_2 from flue gas in power plants and industrial facilities, providing a more stable and cost-effective alternative to traditional amine-based capture systems. High molecular weight facilitates thin-film coating, enabling defect-free membranes as thin as 120 nm. It is a versatile platform for CO_2 separation, medical devices and other applications requiring robust, high-performance membranes. This invention is available for licensing and/or further collaborative research from NETL.

Problems Addressed

- Industrial processes that require CO_2/N_2 separation often depend on membranes that can provide high permeability and selectivity. However, these materials have poor mechanical integrity and aging resistance.
- Other solutions lack robustness and performance when exposed to humidity or prolonged use.
- Complex fabrication steps and difficulties in achieving thin, defect-free films that do not degrade in the presence of water vapor or fluctuating temperatures further complicate efforts, underscoring the need for more reliable, high-performance membrane materials.

Potential Commercial Application

- Industrial CO_2 separation: efficiently removing CO_2 from flue gas and other industrial gas streams.
- CO_2 conversion membrane reactors: for processes designed to convert or utilize CO_2.
- Biomedical and hydrogel-based applications: wound dressings, tissue engineering and drug delivery.

Competitive Advantages

- Features higher CO_2 permeability compared to cellulose acetate.
- Balances permeability and selectivity at levels surpassing established performance limits.
- Maintains adaptability for diverse industrial application.

Intellectual Property Status

A provisional patent application has been filed.

Licensing

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