NETL INVENTS NOVEL THIN FILM COMPOSITE MEMBRANE FOR POST-COMBUSTION CO₂ CAPTURE

NEW POLYMERIC MEMBRANES OUTPERFORM COMMERCIAL MEMBRANES

Membranes with extremely high permeance are needed to make membrane technology economically viable.

NETL’s answer is a thin film composite membrane for post-combustion carbon capture. It has a demonstrated CO₂ permeance of > 4200 Gas Permeance Units (GPU) and CO₂/N₂ selectivity of >30 under lab conditions, far outperforming any commercially available polymer membranes.

The membrane is a new high-permeance polymer support overlaid with an ultra-thin selective layer of a novel rubbery polymer blend.

MEMBRANE SUPPORT DEVELOPMENT

The novel and scalable nanoporous support provides much greater CO₂ permeance (260,000 GPU), surface porosity, and physicochemical stability than commercial polymer porous supports.

SELECTIVE LAYER MATERIAL AND THIN-FILM DEVELOPMENT

NETL P15 rubbery polymer blends have excellent CO₂/N₂ separation performance and anti-aging properties.

The CO₂/N₂ separation performance of sub-200 nm thin film composite membranes exceeds that of state-of-the-art membranes.

P15-V1 (developed in EY20)

P15-V2

P14 CO₂/86 N₂ at 22 °C

Bulk film - 100 µm

2008 upper bound

P15 selective layer

NETL-R6 support

80 nm P15 polymer

PDMS + selective layer = 180 nm

100 nm PDMS gutter layer

P15-V6 fabricating machine

P15-V2 fabricating machine

Roll-to-Roll Membrane Fabrication Machine Envisioned to Help Scale Up and Commercialize

PATENTING AND SCALE-UP DEMONSTRATIONS

Path to Commercialization

NETL has submitted a non-provisional U.S. patent application for the membrane support, and another is being prepared for the selective material. The membrane support and selective material both have high commercial potentials. NETL has been working to scale up the membrane for small module demonstrations in different industrial flue gas point sources like coal-fired power plants, steel mills, and cement plants. NETL plans to establish collaborations with a commercial membrane manufacturer to further scale up and then mature this technology.