Two-Dimensional Nanoporous Covalent Organic Framework for Selective Separation and Filtration Membrane Formed Therefrom

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Description of Technology

Two dimensional (2D) filters have gathered a lot of interest because of their importance and high applicability across many different fields, including image and signal filtering. The promise of 2D materials is largely based on their unique single-layer electrical, optical, and magnetic properties. 2D filters started with the demonstration of the extraordinary properties of graphene and has since been extended to other 2D materials, such as transition metals dichalcogenides, nanoplatelets, and other elemental 2D phases. Currently, 2D materials are not easily modified to suit a given application because they have very little flexibility in adjusting the materials' performance beyond their intrinsic properties. The inflexibility presents a significant barrier to technological implementation and broad use. Attempts have been made to modify graphene, but the pore size becomes too large which weakens the material. As a result, permeation through the graphene membranes remains insufficient to compete with current commercial pressure-driven membranes. There exists a need for a membrane for separations that has both high throughput and highly selective transport or rejection of the species of interest based on size, change, or other molecular properties, but this task has remained elusive.

Researchers at the University of Wyoming have invented a filtration membrane with high filtration selectivity based on specific chemical properties, such as size and charge, while also affording high permeance. The two-dimensional covalent organic framework polymers were synthesized with ionizable carboxylate groups in 2.8nm pores and demonstrates a high membrane selectivity. The membranes are attractive separators due to their small energy requirements and their potential for both fast and selective separations. The membrane has atomic scale capillaries that efficiently allow the separation of the species from solutions and suspensions based on properties depending on the molecular and ionic size.

Applications

The 2D filters that have been created in this invention are both more flexible than current graphene filters and have a higher solvent permanence than current commercial pressure driven membranes. These filters can be used in applications such as image filtering and signal filtering.

Features & Benefits

- High filtration selectivity based on specific chemical properties while also affording high permeance
- Small energy requirements
- Efficiently separates species from solutions depending on different properties.

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