Nanoporous Atomically Thin Breathable Personal Protective Membranes

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

Vanderbilt researchers have developed an atomically thin membrane with extremely high selectivity and permeability for use in personal protective equipment.

Addressed Need

With rising global health threats, there is a pertinent need for successful personal protective equipment (PPE). Within the last couple decades, the presence of airborne viruses, such as the novel coronavirus SARS-CoV-2, has increased. Further, chemical agents, particularly those encountered in military settings, endanger the safety of our service men and women. These ongoing threats require continued development and improvement of PPE.

Technology Description

The membrane technology developed at Vanderbilt for PPE enables ultra-high breathability for over-garment applications within a single material, without compromising protective ability. The novel membrane achieves its ultrathin profile by utilizing atomically thin graphene membranes and a novel process to precisely control the size of nanoscale holes, thereby creating a highly selective, atomically thin membrane that prevents unwanted particles from crossing the boundary. To increase breathability without compromising safety, the size of the holes in the membrane are selectively engineered to be large enough to allow for water vapor to cross the membrane, while simultaneously rejecting larger chemical and biological agents (>1nm).

Commercial Applications

Utilizing this membrane in a PPE application helps to maximize breathability and simultaneously reject harmful molecules from the air, all without adding excess bulk and weight to the PPE. Potential applications could range from healthcare to military use, including individual face coverings, overgarments, clean-room suits, and military uniforms and kits.

Technology Development Status

Testing, refinement, and scale-up of the membrane is ongoing.

Intellectual Property Status

A PCT application has been filed.

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