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Rapid and Surfactant-Free Fabrication Method for Sizable Carbon Nanotube Membranes

Carbon nanotubes (CNT) can be manufactured into thin films for a variety of applications such as filtration and construction. To work effectively in these applications, large area films are necessary. Unfortunately, standard approaches to CNT manufacture are only able to produce small area materials through a complex, expensive process which requires long processing times and expensive binder materials. Due to the complexity of these manufacturing processes, the application of CNT membranes has been limited to lab-scale demonstration, despite a plethora of diverse industrial applications.

Researchers at Arizona State University have invented a rapid and less complex method of producing CNT membranes. A hydraulic press is used without the addition of a binder material or substrate, producing pure CNT membranes at lower cost. The pure CNT membranes are free-standing, stable structures, which can be produced 6-8 times faster than existing methods. Precise control over the thickness and density of fabricated membranes is possible because of the innovative use of the hydraulic press. This fabrication method is equally suitable for obtaining multi-walled as well as single-walled CNT membranes.

Potential Applications

- Filtration
- Construction
- Electromagnetic interference (EMI) shielding
- Large area carbon nanotube films
- Resistive heating and de-icing

Benefits and Advantages

- Low Cost –
  - Simple design can be integrated into existing processes.
  - Expensive surfactants and binder materials from traditional production techniques no longer necessary.
- Longevity – Less degradation of material properties compared to alternative techniques.
- Versatility –
  - No size limitations on produced CNT membranes.
  - High sensitivity to strain offers strain sensing capabilities to membranes.
- Specificity – Physical properties of CNT membranes can be controlled during fabrication.
- Quality –
  - Uniformity in thickness and homogeneity in structure is obtained.
  - Surfactants and binder materials are no longer necessary for production,

resulting in higher purity and functionality of membranes.

- Energy Efficiency – Use of hydraulic press results in reduced energy consumption compared to traditional fabrication processes.

For more information about the inventor(s) and their research, please see

Dr. Aditi Chattopadhyay's directory webpage

Siddhant Datta's directory webpage