

# GRAPHENE OXIDE PERVAPORATION MEMBRANE

**A more cost effective and  
more selective alternative  
to currently employed  
dehydration processes**

## BACKGROUND

In many industries, the removal of water is vital for quality assurance, purification and concentrating of liquids, this is of particular importance in the energy, food and chemical sectors. In the energy sector the presence of water can have detrimental complications as it can lead to corrosion of the infrastructure resulting in costly downtime. The chemical sector requires the removal of water for a variety of reasons, for example the dehydration of solvents such as ethanol which forms azeotropes with water or for the removal of water in esterifications to bias the equilibrium in favour of the products.

Currently dehydration is facilitated either by energy intensive distillation, by the addition of molecular sieves or more increasingly through pervaporation. Current pervaporation membranes are made from polymeric materials that can be detrimentally affected by high temperatures or solvents.

## THE TECHNOLOGY

Academics at the University of Manchester (UoM) have developed a pervaporation membrane that utilises the inherent water transportation properties of graphene oxide (GO) to act as a selective water permeable barrier for dehydration applications.

The UoM GO pervaporation membranes are porous to water but impermeable to gases/ molecules larger than  $9\text{\AA}$  when hydrated, thus enabling the separation of water molecules from liquid and/or gas mixtures. It provides a more cost effective and more selective alternative to currently employed dehydration processes.

## KEY BENEFITS

- Fast transport of water vapour through the membrane
- Membranes are impermeable to everything but water vapour
  - Reduced solvent loss
- Separation of water from mixtures that would not tolerate distillation
- Simple membrane preparation from readily available raw materials
- Durable and extended lifetime
- Low energy intensive alternative to distillation or molecular sieves
  - No chemical drying
  - No manual charging
  - No generation of wastewater
- Recyclable
- Simpler production methods

## APPLICATIONS

- Dehydration or drying of compounds
- Concentration of compounds from aqueous media
- Reaction biasing, for example the removal of water in esterification reactions
- Separation of compounds that form azeotropes with water

## INTELLECTUAL PROPERTY

A patent application has been filed to protect this technology in a number of worldwide territories.

## PUBLICATIONS

**Unimpeded Permeation of Water Through Helium-Leak-Tight Graphene-Based Membranes** Nair et al., Science, 335, 442, 2012, DOI: 10.1126/science.1211694.

## OPPORTUNITY

We are seeking a licensee or an industrial collaborator to further develop and commercialise this technology.

## UMIP REFERENCE

20110442.

## UMIP

Core Technology Facility, 46 Grafton Street, Manchester M13 9NT, United Kingdom  
T: +44 (0)161 603 7600 / F: +44 (0)161 606 7307 / E: [graphene@umip.com](mailto:graphene@umip.com) / [www.umip.com](http://www.umip.com)