

Oleophobic/Hydrophilic Graphene-based Membranes for oil-spill clean up.

Three Minute Thesis Presentation

'PhD student Rachel McLaren's chemistry doctorate involves the development of new graphene based materials containing poly-yne groups for advanced applications. Rachel's project investigates covalent and non-covalent synthetic procedures to functionalise the surface of the materials, and quantify these via analytical techniques. She is investigating the application of multi-layer graphitic composites within membrane synthesis. The project also looks at the porous structures of the materials, and how these can be altered and tailored for advanced applications.'

[Three Minute Thesis - Rachel McLaren | Chemistry PhD - YouTube](#)

My research involves the synthesis of oleophobic hydrophilic graphene membranes for oil spill cleanup. **Clear focus**

Oil spills have huge economic and environmental impacts and can cause a number of problems for aquatic life.

Oil spills usually involve accidents upon large tankers in the ocean and result in the accumulation of an oil layer on the surface of water which can poison many organisms including fish.

As such, we see here an unhappy looking fish swimming below a layer of oil which is represented by the red droplets **The problem**

At present, a number of methods exist to remove oil from water including booms dispersants solvents and in situ burning. **Current solutions**

However, none of these methods are free of their drawbacks and are made even more difficult by various phenomena including the spreading and sinking of oil. **gap**

It is therefore imperative to investigate alternate strategies to remove oil from water systems so within my work i have synthesized a novel graphene-based membrane which enables oil water separation as shown within the photograph to the left. **Aims**

We see that this membrane is very black in colour and this originates from the dark graphene material in which it comprises.

These membranes are considered oleophobic meaning that they repel oil while simultaneously displaying hydrophilic behaviour meaning that they allow water through.

Electron microscopy images such as the one shown within the centre of the slide reveals that the membrane consists of an interesting porous structure consisting of a network of holes and channels seen within the dark regions and these allow

easy passage of water.

Meanwhile the membrane contains a unique polymer which provides the oil repelling oleophobic behaviour.

The presence of graphene within these membranes has several advantages.

It provides them with large surface areas, high strength and flexibility and this originates from the honeycomb structure of carbon which we see here within the magnifying glass.

These membranes can be synthesized really easily by simply mixing the graphene material with the necessary polymers in water and allowing them to dry in air.

The membranes can then be used as they are or they can be coated upon various Substrates.

We see here that when we coat the membrane upon carbon fibre, it can be used as a net to scoop up oil from the surface of water as the water runs through the membrane.

The oil is left on the surface of the membrane and can be simply poured off and the membrane reused. **The innovation/The Science**

As such, we now see a happy looking fish swimming in water free of oil.

So we have had much success with these membranes and have investigated their chemical and morphological structures in some detail.

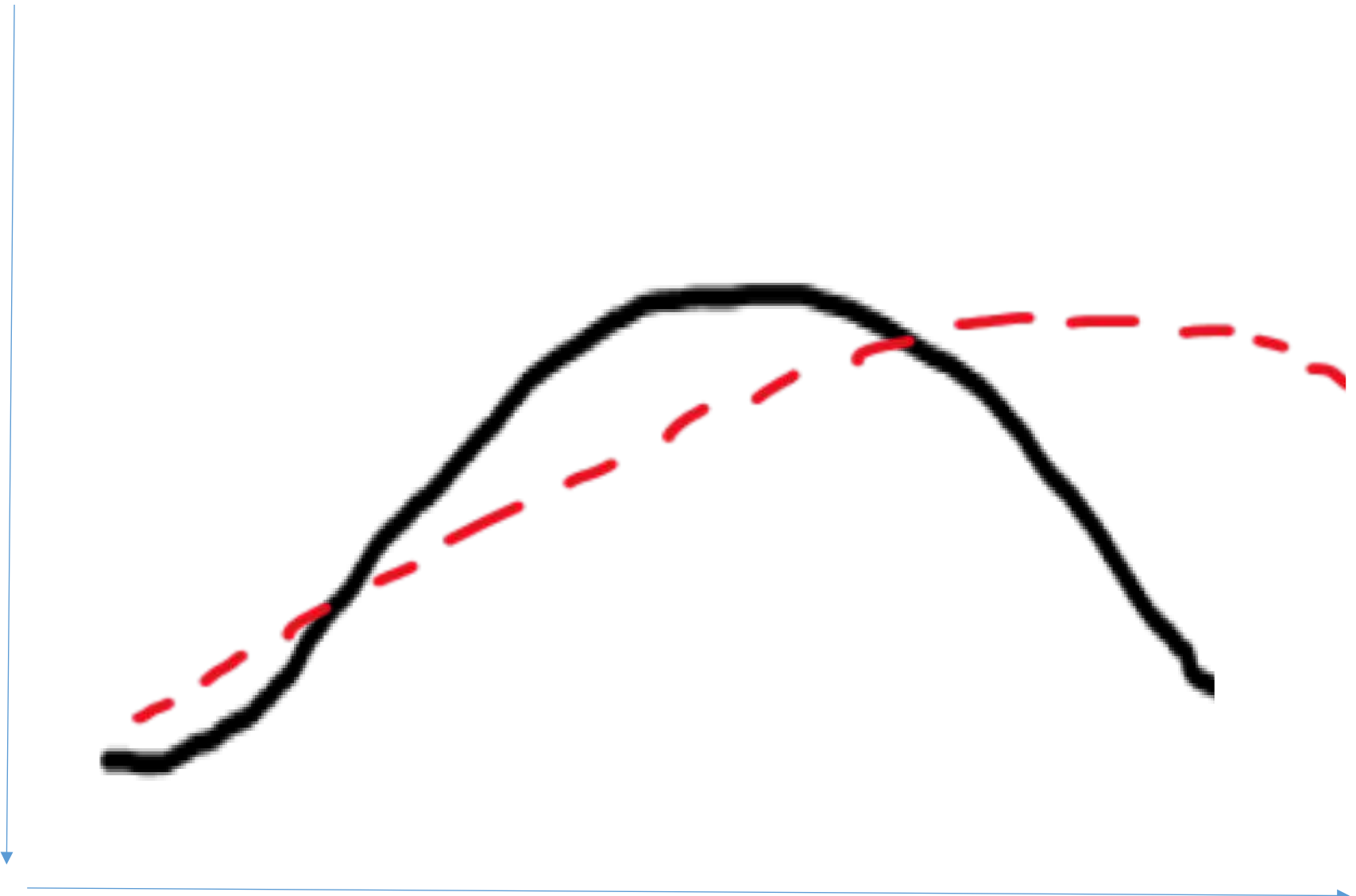
As such we therefore believe that these membranes are an exciting new technology which could really make a difference to oil spill clean up in real world applications.

Real-world/ impact

SG –
Abstract/ Technical
Not tied to context.

Plotting Semantic
Gravity

SG +
Concrete/unpacked
Tied to context.



Plot the wave through the time of the presentation

Monbec, L., 2018. Designing an EAP curriculum for transfer: A focus on knowledge. *Journal of Academic Language and Learning*, 12(2), pp.A88-A101.
Maton, K., 2013. *Knowledge and knowers: Towards a realist sociology of education*. Routledge.