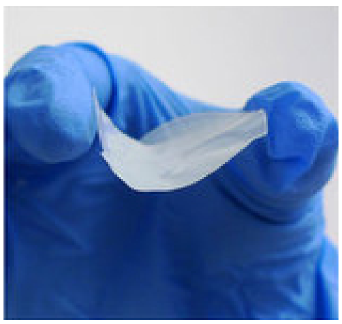
Scientists create revolutionary material to clean oil spills

November 30 2015



Freestanding boron nitride membrane. Credit: Deakin University

Deakin University scientists have manufactured a revolutionary material that can clean up oil spills, which could save the earth from potential future disasters such as any repeat of the 2010 Gulf Coast BP disaster that wreaked environmental havoc and cost a reported $40 billion.

The major breakthrough material, which literally absorbs the oil like a sponge, is the result of support from the Australian Research Council and is now ready to be trialled by industry after two years of refinement in the laboratory at Deakin's Institute for Frontier Materials (IFM).

Alfred Deakin Professor Ying (Ian) Chen, the lead author on a paper which outlines the team's breakthrough in today's edition of *Nature Communications*, said the material was the most exciting advancement in oil spill clean-up technology in decades.

"Oil spills are a global problem and wreak havoc on our aquatic ecosystems, not to mention cost billions of dollars in damage," Professor Chen said.

"Everyone remembers the Gulf Coast disaster, but here in Australia they are a regular problem, and not just in our waters. Oil spills from trucks and other vehicles can close freeways for an entire day, again amounting to large economic losses.

"But current methods of cleaning up oil spills are inefficient and unsophisticated, taking too long, causing ongoing and expensive damage, which is why the development of our technology was supported by the Australian Research Council.

"We are so excited to have finally got to this stage after two years of trying to work out how to turn what we knew was a good material into something that could be practically used," Professor Chen said.

"In 2013 we developed the first stage of the material, but it was simply a powder. This powder had absorption capabilities, but you cannot simply throw powder onto oil – you need to be able to bind that powder into a sponge so that we can soak the oil up, and also separate it from water."

The lead author on the paper, IFM scientist Dr Weiwei Lei,) an Australian Research Council Discovery Early Career Research Awardee, said turning the powder into a sponge was a big challenge.

"But we have finally done it by developing a new production technique," Dr Lei said.

"The ground-breaking material is called a boron nitride nanosheet, which is made up of flakes which are just several nanometers (one billionth of a meter) in thickness with tiny holes which can increase its surface area per gram to effectively the size of 5.5 tennis courts."

Boron nitride nanosheet next to spike of a plant. Credit: Deakin University

The research team, which included scientists from Drexel University, Philadelphia, and Missouri University of Science and Technology, started with boron nitride powder known as "white graphite" and broke it into atomically thin sheets that were used to make a sponge.

"The pores in the nanosheets provide the surface area to absorb oils and organic solvents up to 33 times its own weight," Dr Lei said.

Professor Yury Gogotsi from Drexel University said boron nitride nanosheets did not burn, could withstand flame, and be used in flexible and transparent electrical and heat insulation, as well as many other applications.

"We are delighted that support from the Australian Research Council allowed us to participate in this interesting study and we could help our IFM colleagues to model and better understand this wonderful material, " Professor Gogotsi said.

Professor Vadym Mochalin from Missouri University of Science and Technology said the mechanochemical technique developed meant it was possible to produce high-concentration stable aqueous colloidal solutions of boron nitride sheets, which could then be transformed into the ultralight porous aerogels and membranes for oil clean-up.

"The use of computational modelling helped us to understand the intimate details of this novel mechanochemical exfoliation process. It is a nice illustration of the power, which combined experimental plus modelling approach offers researchers nowadays."

Provided by Deakin University