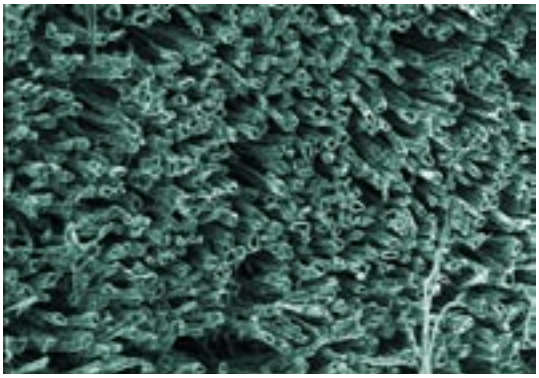
Nanotube fuel tanks

by Tim Wetherell

Rising world oil prices and concerns about greenhouse gas emissions are increasing pressure to find a viable alternative to petrol and diesel as transport fuels. One very promising candidate is hydrogen which can be combined with atmospheric oxygen in fuel cells to produce the large quantities of electrical power required to drive a car.



Nanotubes may provide a solution to our hydrogen storage problems.

Handling of the ultra-fine powders used to generate nanotubes has to be carried out in a special controlled atmosphere glovebox.

Hydrogen is a very attractive transport fuel because it is abundant, renewable and its consumption in fuel cells produces no greenhouse emissions at all. But hydrogen, being a volatile gas, does come with some safety problems. Both gas cylinders and hydrogen liquid in cryogenic containers present an explosion hazard in the event of an accident.

One revolutionary option for hydrogen storage is carbon nanotubes - microscopic cage-like tubes of carbon atoms. Because of their structure and size the tubes have the ability to adsorb hydrogen gas in large quantities. This can then be re-released with mild heating. One stumbling block is that to date, manufacture of very large quantities of nanotubes has simply not been an economically viable proposition.

However, work by scientists at the ANU may be set to change all this. A novel process involving high-energy ball milling followed by a series of carefully controlled annealing stages has enabled scientists to manufacture large quantities of nanotubes in carbon, boron nitride and other materials cheaply and easily. The research is being led by Dr Ying Chen from the Department of Electrical Materials Engineering (RSPSE).

The ANU process is readily adaptable to being up-scaled to manufacture nanotubes in industrial quantities, and has led to the commercial availability of boron nitride tubes for the first time. It is now hoped that the ANU nanotube technology will be a crucial step on the road to hydrogen cars and a safer, cleaner environment.

More info: Ying.Chen@anu.edu.au

The pick of the crop

by Jerry Skinner

Using the ratios of stable carbon isotopes in carbon dioxide readings around plants in various conditions, researchers are now able to pick which crop plants use water most efficiently. The technique is known as the Delta Technique and has been developed by a team led by Professor Graham Farquhar at the Research School of Biological Sciences (RSBS) together with scientists at CSIRO Plant Industry. The technique has already been used successfully to develop two new varieties of wheat.

Put simply, Delta Technique measures each plant's water-use efficiency and allows plant breeders to identify which plants to back-cross with commercial cultivars to produce a new variety. It means that only the most water-use efficient plants are used in the breeding process.

The new technique has the potential to produce crops which can produce 5 percent more grain for the same rainfall.

As Australia is one of the driest continents in the world, this technique is very welcome, producing over 5 percent more grain for the same rainfall in the new varieties. However, it has been shown to work in wetter climes too.

Professor Farquhar is head of the Environmental Biology Group in the Research School of Biological Sciences at ANU. A biophysicist by training, he has worked in plant biology and climate change for many years. He is also renowned for his work on the effects of global change, including rising levels of atmospheric carbon dioxide and climate change.

Professor Graham Farquhar

More info: Graham.Farquhar@anu.edu.au