Black Gold for Green Cars

The next generation of electric-car batteries may thrive on a liquid that looks like crude oil.

Ferris Jabr

The tiny glass bottle in my hand is filled.with what looks like crude oil, but it's actually oil's nemesis. If it works, this black sludge will transform the rechargeable battery, doubling the range of electric cars and making petroleum obsolete.

Today's electric cars are handicapped by batteries that are heavy, expensive and a waste of space. Two-thirds of the volume of the battery in Nissan's Leaf electric car, for example, consists of materials that provide structural .. support but generate no power. And those materials cost more than the electrically active components.

One way to vastly improve rechargeable batteries is to put more of that deadweight to work. That's the purpose of the secret sauce in the bottle, nicknamed 'Cambridge Crude' by Yet-Ming Chiang and his colleagues at the Massachusetts Institute of Technology, who developed it.

In a standard battery, ions from one solid electrode travel to the other through a liquid or powder electrolyte. This in turn forces electrons to flow in an external wire linking the electrodes, causing a current. In Chiang's battery, the electrodes take the form of tiny particles of a lithium compound mixed with a liquid electrolyte to make slurry. The battery uses two streams of slurry, one positively charged and one negatively charged. Both are pumped across aluminium and copper current collectors with a permeable membrane in between. As they flow the streams exchange lithium ions across the membrane, causing a currenfto flow externally. To recharge the battery, you apply a v,oltage to push the ions back across the membrane.

The MIT creation is a type of flow battery, which normally has a liquid electrolyte.that moves past stationary electrodes. Chiang reckons that the power per unit delivered by his lithium 'semi-solid' flow battery will be ten times that of conventional designs.

'This is probably the most exciting development in electrical energy storage in the last couple of years,' says Yuri Gogotsi of Drexel Nanotechnology Institute in Philadelphia, Pennsylvania. 'Chiang offers a unique hybrid between a flow battery and a lithium-ion battery.'

Drivers could have three ways of recharging the semi-solid flow battery. They could pump out spent slurry and· pump in fresh; head to a recharge station where tanks·of spent slurry would be replaced with fresh ones; or recharge the slurries with an electrical current. In the first two cases, regaining full power should only take a matter of minutes.

Rechargeable batteries are the heaviest and most expensive components of electric cars by a large margin. Chiang estimates that the cost of manufacturing his team's battery will be $250 per kilowatt-hour of generating capacity. So if one were built to replace the 24-kilowatt battery in the Nissan Leaf, it would cost$6000. This is about one-third the cost of existing batteries, and just low enough to compete with gasoline. Chiang also calculates that Cambridge Crude would let a car travel at least 300 kilometres on a single charge, double what is possible with today1 s batteries.

'This is an especially beautiful technology,' says Dan Steingart, of the City University of New York Energy Institute, because you can recharge the spent slurry. But he adds that even if the team manages to create a prototype car battery within five years, building the recharge stations to support it would take much longer.

Last year Chiang, his colleague Craig Carter and entrepreneur Throop Wilder founded a company called 24MTechnologies to develop the battery. They have raised $16 million in funding so far, and plan to have a compact prototype ready in 2013.

Choose the appropriate letters A, 8, C or D to answer questions 1-6.

1. This passage is about Yet-Ming Chiang's work on

A developing a new car.

B developing a new car that works on a battery.

C developing a new car battery that is rechargeable.

D developing a new rechargeable car battery that uses a new fuel

2. What is not true about the batteries in today's electric cars?

A They are difficult to recharge.

B They are too expensive.

C They take up a great deal of space.

D They are much heavier than a standard battery.

3. Chiang's battery

A combines elements of lithium battery and flow battery.

B moves ions through a powder electrolyte.

C will allow cars to travel ten times as far on a single charge.

D can be produced for $250.

4. 'Cambridge Crude'

A could never replace petroleum.

B has taken five years to develop.

C is similar to crude oil in appearance.

D will be cheaper than gasoline.

5. Drivers who want to recharge their batteries

A will usually be able to do so within minutes.

B will need an electric current.

C must replace the slurry.

D can go to their local gas station.

6. A prototype of the battery

A requires a great deal more funding.

B had been built at the time of writing.

C could be available to buy by 2013.

D will be developed before recharge stations are built