Graphite + water = the future of energy storage

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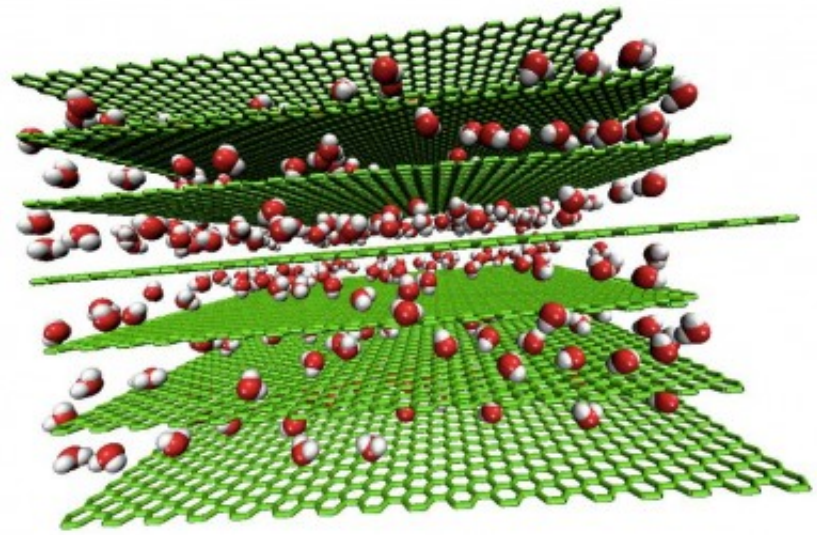

Graphene sheets. Credit: Gengping Jiang

A combination of two ordinary materials – graphite and water – could produce energy storage systems that perform on par with lithium ion batteries, but recharge in a matter of seconds and have an almost indefinite lifespan.

Dr. Dan Li, of the Monash University Department of Materials Engineering, and his research team have been working with a material called graphene, which could form the basis of the next generation of

ultrafast energy storage systems.

“Once we can properly manipulate this material, your iPhone, for example, could charge in a few seconds, or possibly faster.” said Dr. Li.

Graphene is the result of breaking down graphite, a cheap, readily available material commonly used in pencils, into layers one atom thick. In this form, it has remarkable properties.

Graphene is strong, chemically stable, an excellent conductor of electricity and, importantly, has an extremely high surface area.

Dr. Li said these qualities make graphene highly suitable for energy storage applications.

“The reason graphene isn’t being used everywhere is that these very thin sheets, when stacked into a usable macrostructure, immediately bond together, reforming graphite. When graphene restacks, most of the surface area is lost and it doesn’t behave like graphene anymore.”

Now, Dr. Li and his team have discovered the key to maintaining the remarkable properties of separate graphene sheets: water. Keeping graphene moist – in gel form – provides repulsive forces between the sheets and prevents re-stacking, making it ready for real-world application.

“The technique is very simple and can easily be scaled up. When we discovered it, we thought it was unbelievable. We’re taking two basic, inexpensive materials – water and graphite – and making this new nanomaterial with amazing properties,” said Dr. Li.

When used in energy devices, graphene gel significantly outperforms current carbon-based technology, both in terms of the amount of charge

stored and how fast the charges can be delivered.

Dr. Li said the benefits of developing this new nanotechnology extend beyond consumer electronics.

“High-speed, reliable and cost-effective energy storage systems are critical for the future viability of electricity from renewable resources. These systems are also the key to large-scale adoption of electrical vehicles.

“Graphene gel is also showing promise for use in water purification membranes, biomedical devices and sensors.”

Provided by Monash University

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