

What is a Graphene battery and how can it change the world of technology?

Batteries are at the heart of humanity's most important applied technologies. Your phone, laptop, car and even your house... all rely on storing energy in batteries.

However, it seems that battery technology has not yet been able to keep up with this development. In other words, the battery is the 'dump' in the field of mobile technology, although it has also improved relatively much over the years.

This is not to say that current battery technology is bad, but a recently emerged battery technology called graphene is expected to be able to almost completely solve the general shortcomings.

What is Graphene?

Simply put, graphene is the world's thinnest material, made up of carbon atoms linked together in a cyclic hexagonal pattern. More specifically, the Graphene lattice is only one atom thick, essentially crystalline carbon. It may sound strange, but you can make graphene flakes with just a pencil nib and some tape. In fact, this seemingly simple creative idea has received a Nobel Prize.

Graphene has a number of properties that make it very interesting as a potential part of future technology. The advantage of graphene is its ability to conduct electricity, withstand heat well and limit energy loss when current flows. So if you want to transmit electricity or heat with high efficiency, this is a promising material.

Graphene is also highly durable. It is very flexible and elastic, and at the same time transparent, and can be used to generate electricity from sunlight.



Graphene is difficult to mass-produce

There is one major barrier that makes dry graphene popular, and that is the complexity of mass production. While it's fairly simple to create small flakes or sheets of graphene for lab study, mass production is another matter. Without the challenges of reliable mass production, this type of nanomaterials would have been present in technological products long ago.

The good news is that there are several promising avenues for mass-production and cost-reduction ambitions for graphene materials that are cheaper enough to hit the mass market. Currently, Graphene-infused fiber can be produced in reasonable quantities. Graphene can also be made using solvents, although they are very toxic. Researchers have looked at safer solvents, and the outlook is also promising.

Graphene is now commonly produced by chemical vapor deposition. In it, graphene forms as a layer on top of the substrate material. The problem with this approach is that the rate of structural 'errors' in graphene is consistently high. New research using liquids (with a perfectly flat surface) as a substrate could solve the problem. So, assuming that graphene can be mass-produced, it is entirely possible for them to appear in mainstream technological products.

Graphene solves limitations of Lithium-Ion batteries

Lithium is a common type of battery that you can find in consumer electronics. However, this type of battery has a major disadvantage that the ability to store energy is not really good, and it needs a safe circuit to ensure stability in use.

In particular, Lithium batteries will also degrade in quality after each recharge, have a limit on the amount of power they can provide at one time, and must be charged slowly to prevent the battery from overheating leading to explosion.

Graphene batteries can overcome or mitigate most of these limitations. Adding graphene to existing lithium batteries can significantly increase their capacity, help them charge quickly and safely, and significantly extend their lifespan before needing to be replaced.

Solid-state batteries do not have liquid electrolytes. It is the substance that sits between the two terminals of a battery and stores chemical energy that is converted into an electric current. Creating practically large solid-state batteries for commercial use remains a goal of the future, but graphene could be the right candidate to make solid-state batteries a mass-market reality.

In a graphene solid-state battery, the material is mixed with ceramic or plastic to further increase electrical conductivity. For example, scientists have created a prototype graphene-ceramic solid-state battery that could be a safe, fast-charging alternative to lithium-ion batteries that are made up of volatile liquid electrolytes. .

Overall, graphene remains an expensive and complex material to manufacture. It was estimated that a kilogram of graphene was worth more than \$300,000 a few years ago. Using graphene batteries will certainly increase product costs significantly, so the commercial prospect of this battery will still be a long way off.

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