

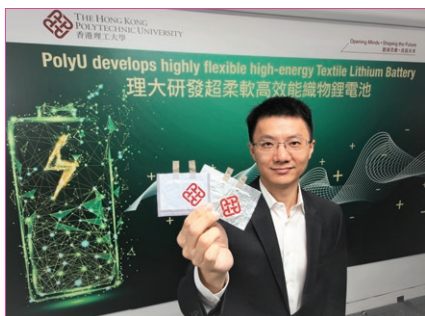


Technology Frontier

News Bite on PolyU's Innovation

Rechargeable Textile Lithium Battery Lightweight, compact, foldable and high-capacity energy source

Wearable technology is an exciting sector with promising potential. But as devices are becoming smaller, lighter and more powerful, it is also harder to fit in a battery with decent capacity. Smart clothing, in particular, entails a battery that is flexible, lightweight and safe, but the market lacks a battery that fulfil all these requirements. Therefore, researchers from the Institute of Textiles and Clothing invented a novel textile lithium battery. On top of its outstanding electrical performance, it also withstands all sorts of mechanical wear and tear without breaking down or causing safety hazard. It literally powers and empowers wearable devices, opening up a whole new world of possibilities.



Prof. Zijian Zheng

Yes, I know. You have your fitness tracker bracelet, a smart watch and a VR headset. And yes, you've kept track of wearable technologies well enough. But electronic giants from around the world are still looking for the next big things to put on your body, such as smart glasses that shoot videos and control a drone, or translation earbuds that erase the language barrier instantly. It was forecasted that the wearable market will be worth US\$150 billion by 2026¹. But there is still one key issue underlying the advancements in wearable technologies – you can't do much without good battery life. In fact, the lighter and smaller a wearable device is, the harder it is to pack enough juice for decent

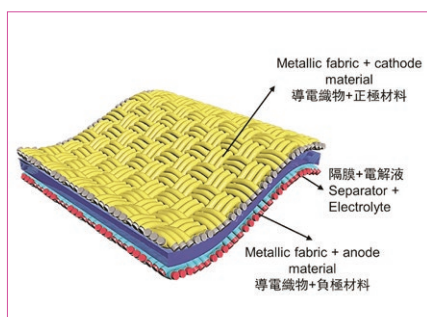
running time. To complicate the issue further, for smart clothing, one of the fastest growing wearables², the battery needs to be flexible, and preferably washable. That's why Prof. Zheng Zijian of the Institute of Textiles and Clothing and his research team developed a novel textile lithium battery. Not only is it flexible, compact and high in charge capacity, it also withstands all sorts of mechanical wear and tear without losing its functions or compromising user safety, making it the perfect energy source for all wearables of the future.

Issues with existing rechargeable batteries

Most handheld electronics, such as smartphones and tablets, use



Textile lithium batteries



Configuration of the flexible textile lithium battery



The Textile Lithium Battery won a gold medal and two special merit awards in the 47th International Exhibition of Inventions of Geneva.

conventional lithium rechargeable batteries made with metal foil or metal plates. Despite their plummeting prices in the past decade, these batteries are rigid, bulky and heavy, not exactly useable on intelligent textiles. There are actually bendable lithium batteries on the market. Though they are lightweight and slightly more flexible than conventional ones, they hold little power and are still not flexible enough. "Because of the rigid and brittle metal foils, bendable batteries would still work if curved, but not folded. For a battery to truly function well on apparels such as heated jackets and smart insoles, we need it to have the same consistency and flexibility as fabric. That was how we came up with the idea of replacing metal foil with metallic fabric," explained Prof. Zheng.

High power capacity and fast charging

Metallic fabrics are created by coating fabrics with highly conductive copper and nickel metals using our patented technology. As the metallic fabric is more conductive than metal foil and provides more surface area for holding charge, the battery has excellent electrical performance. Despite its thickness of less than 0.5 mm, textile lithium battery holds more than twice as much electricity as a bendable lithium battery of the same volume. Its high conductivity also means it charges more quickly. After 500 charge-and-discharge cycles, it still holds 80% of its original energy capacity and will last for up to 1,000 cycles.

Remarkable mechanical durability and safety

Ideal professional sports apparel should be able to tolerate the impact force inherent in most sports and to resist normal wear and tear. In this regard, the Textile Lithium Battery has an extra competitive edge – it can withstand harsh mechanical impact without breaking down or causing any safety hazard. In the experiment, the battery functioned as usual after being repeatedly folded in half, twisted at different angles and crumpled for over 1,000 times. It was then hammered, pierced through by nails, and partly cut with scissors, and you guess right – it still worked like nothing had happened, without overheating, catching fire or bursting. That means textile lithium battery is safe even in case of traumatic accidents. What's more, clothing with textile lithium battery can be washed without removing the battery.

In April 2019, the Textile Lithium Battery won a gold medal and two special merit awards at the 47th International Exhibition of Inventions of Geneva, Switzerland.

¹ Manners, David. "Wearables Market worth \$30bn, says IDTechEx." 8 July 2016. *Electronics Weekly.com*. Retrieved from <https://www.electronicsweekly.com/news/business/wearables-market-worth-30bn-says-idtechex-2016-07/>

² Bell, Lee. "Fresh Developments In Fabric Tech Could Finally Push The Arrival Of 'Truly Wearable' Smart Garments." *Forbes*. 29 April 2019. Retrieved from <https://www.forbes.com/sites/leebebelltech/2019/04/29/fresh-developments-in-fabric-tech-could-finally-push-the-arrival-of-truly-wearable-smart-garments/#3e81889f2114>