
Linchao Zeng

Shaohua Chen, Chuang Yang, Lin Qiu and Huiming Cheng

Tsinghua-Berkeley Shenzhen Institute, University Town, Shenzhen, China

292773120@qq.com

Integrated paper-based stretchable LIBs

With the development of technologies, the people's comfort level and experience degree of electronics are improving. As one developing direction of electronics is flexible and wearable, it puts forward a new request for energy storage devices.[1] Making energy storage devices flexible and integrating it with flexible electronics can lead a maximally comfort level and experience degree of electronics for people. Currently, the energy storage devices for electronics are lithium ion batteries, as lithium ion batteries owns a series of advantages compared with other energy storage devices. It has a much higher energy density compared with supercapacitors and Na-ion batteries, and it has a much more wonderful cycling stability compared with lithium-sulfur batteries. So the flexible energy storage devices for flexible electronics are mostly based on lithium ion batteries. As traditional lithium ion batteries has no flexible features, lithium ion battery products with excellent flexibility are urgently needed in the market.[2]

In recent years, scientists has achieved much progress in this field. Paper-based, film-like, fiber-like, textile-like and some new structure flexible LIBs have been prepared to achieve excellent stability of LIBs. In these methods, paper-based flexible batteries have advantages like processing easy, low cost and high energy density.[3] For application, the most important flexible form is stretchable. So, based on paper-based flexible LIBs, to realize the stretchability of battery is very important. Kirigami has been confirmed a good method to prepare stretchable LIBs.[4] However, as we known, the inner structure of traditional LIBs may be destroyed when shape change of battery occurs under outside forces.[5] This will cause mismatch of each layer in battery and finally cause deterioration of electrochemical performance and safety problem.[6] The destroy of inner structure of flexible LIBs (especially for kirigami stretchable LIBs) will be more serious as flexible LIBs are working under dynamic environment. So, the stability and safety problem of kirigami stretchable LIBs will be a serious challenge for application. Based on these, we used a simple method to prepare kirigami stretchable LIBs with integrated structure. The alignment quality of each layer is well controlled when stretched and mismatch of the correlated multiple layers when stretched is avoided in this structure.

References

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Figures

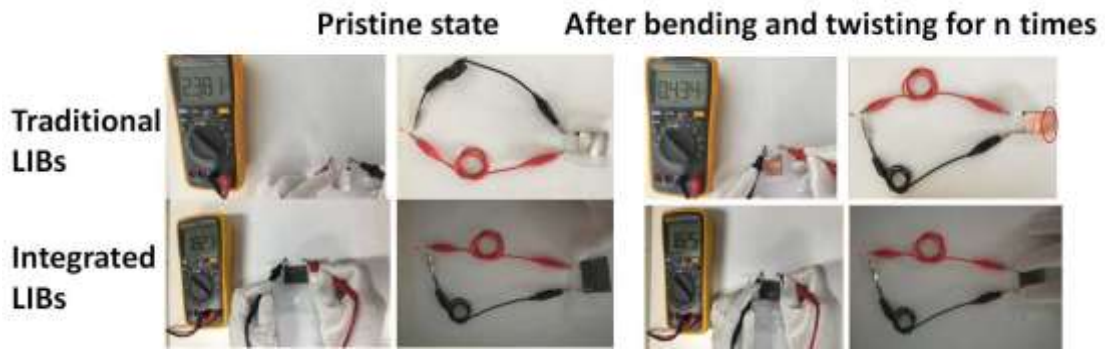


Figure 1: Mismatch of the correlated multiple layers between integrated structure and traditional structure