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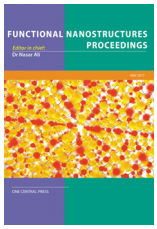

Fiber-shaped, Fexible and Wearable Asymmetric Supercapacitors

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ABSTRACT

Flexible and wearable electronic device has attracted abundant attention, and it embraces considerable applications in various fields such as smart clothing, electronic skin and soft phone, etc.. The mechanical flexibility and stitchability of fiber-shaped energy storage device are an important part of wearable device. Meantime, as the energy storage and conversion devices, fibrous supercapacitor is an important energy storage device in self-charging power system and provide energy for monitoring system. In this work, we develops a series of rechargeable power system, self-energized monitoring system and self-charging power-self energized monitoring system.

I. INTRODUCTION

With the rapid development of flexible and portable electronics, wearable integrated devices with multiple functionalities has become an important tendency in mordern electronics. As an advanced electronical products, flexible self-charging power system can be used to charge the energy storage device, and flexible smart sensors can be used to gather and exchange data for monitoring ambient information, including temperature, light intensity, hazardous gas, humidity, etc.. Recently, incorporated wearable electronics with flexible sensors have aroused abundant attention due to the appearance of smart healthcare detection system, which can act as electronic skin attaching the human body to monitor ambient information. However, flexible sensors cannot be directly utilized in most electronic devices due to lacking of the providing of output power.

Therefore, it is very necessary to employ electrochemical energy storage systems to offer a stable and durable output power. The best effective strategy is building an all-in-one flexible system, which is superior to an external power supply because of its unconvenient in wearable electronic technologies. Very recently, an all-in-one flexible system on a one piece of paper has been reported, which embrace a excellent integrated system. However, planar integrated configurations may limit their practical applications in the wearable electronic field due to heavy weight, major volume, comparing with fiber-shaped integrated configurations with mutiple functionalities. Therefore, it is urgently to construct a integrated configurations for realization of both high-performance energy storage device and ultra-sensitive sensors with mutiple functionalities (gas sensor, pressure sensor, photodetector, humidity sensor, etc.) in one fiber. As a high-efficient flexible energy storage device, flexible fiber-shaped supercapacitors (FFSCs) have attracted increasing attention due to its excellent promising characteristics of fast charge/discharge rate, high power density, long cycling stability, and splendid stitchability. However, low energy density of FFSCs device limited their virtual application in flexible and wearable field. Recently, a nice strategy of constructing a asymmetric supercapacitor has been extensive studied and the high-energy-density of devices were obtained by improved the operating voltage window. However, the asymmetric coaxial FFSCs (ACFFSCs) with a larger specific capacitance are highly desirable. Therefore, our target is amplifying the specific capacitance of device by increasing the specific capacitance of fibrous electrode materials.

As ideal pseudocapacitive materials, many kinds of materials (MnO_2 MoS_2 ,Fe_2O_3, V_2O_5, VN, etc.) are charming candidate of FFSCs because of its facile approach, low cost, broad electrochemical operating voltage

window, high theoretical specific capacitance and environmental friendly, etc., comparing with traditional electrical double layer capacitors. Meanwhile, pseudocapacitive materials possesses the higher energy density due to its major active sites, reversible and rapid redox reactions. However, in fact that the lower specific capacitance of pseudocapacitive materials were obtained due to facile structure and low electronic conductivity.
Therefore, our strategy is constructing a hierarchical three dimensional structure consisting of highly conductive holder as three dimensional conductive scaffold and pseudocapactive transitional metal oxide as active substance. Except for strengthening the technical performance of modern flexible wearable electronic devices, the practical functionality of electronic devices is also important factor in our daily life. Therefore, out targat is constructing a self-charging power-self energized monitoring system that can connect the rechargeable power system and self-energized monitoring system.

As a conceptual exhibition, a high-performance fiber-shaped integrated multifunctional wearable electronic devices was fabricated, which incorporated nanogenerator, FFSCs with sensor.

II. SUMMARY

In this work, we develops a series of rechargeable power system, self-energized monitoring system and self-charging power-self energized monitoring system. And thus it should be useful to people.

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