Cover Profile
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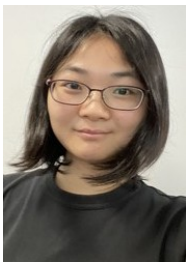
Zinc-Ion Hybrid Supercapacitors: Progress and Future Perspective



Xuefei Gong

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Pooi See Lee

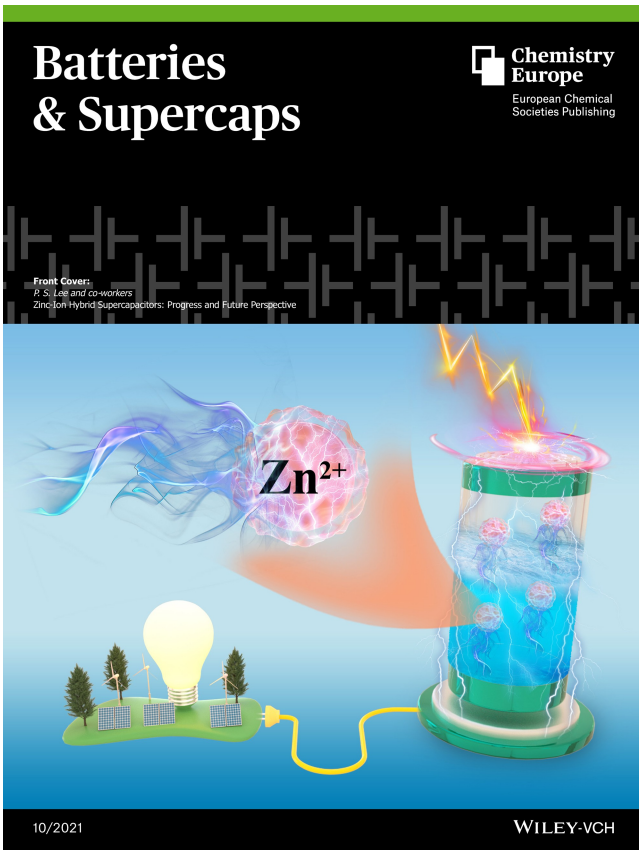
Invited for this month's cover picture is the group of Prof. Pooi See Lee. The cover picture shows environmentally friendly Zn^{2+} -based energy storage devices. In view of their merits including good safety, low costs, satisfactory energy density and power density as well as environmental friendliness, Zn-ion hybrid supercapacitors are promising energy storage devices. Read the full text of the Review at 10.1002/batt.202100034.

What is the most significant aspect of this review?

The review summarizes the recent advancements/achievements in Zn-ion hybrid supercapacitors and categorizes the adoptable approaches to improve their electrochemical performance. Additionally, future developments of Zn-ion hybrid supercapacitors are envisioned, including enhancing active material utilization rate and increasing power output as well as multi-functional integration for practical applications.

How would you describe to the layperson the significance of this review?

For energy storage devices, we should consider how much energy can be stored per unit (energy density) and how fast they can be charged (power density). However, these two parameters (energy density and power density) are often contradictory, which makes it challenging to achieve both high energy density and power density in one energy storage device. Normally, batteries provide impressive energy density while supercapacitors deliver excellent power density. Thus, it is desirable to combine battery and supercapacitors together, which results in hybrid supercapacitors. Meanwhile, costs and safety should also be considered for practical applications. Here, Zn-ion hybrid supercapacitors are investigated owing to the impressive merits, including the rich abundance, low costs, high capacity, safe handling of zinc metal, and aqueous electrolyte utilization with enhanced safety.



What prompted you to investigate this topic?

The increasing demands in portable electronics, electric vehicles, wearable electronics, and miniaturized devices have spurred the exploded developments of energy density devices. However, neither batteries nor supercapacitors alone can meet the requirements of both high energy density and power density simultaneously, thus, the investigations of hybrid supercapacitor combining merits of batteries and supercapacitors are inspired. Among these alkali metal (e.g., Li, Na, Mg, Al, and K)-based hybrid supercapacitors, flammable organic electrolytes, or limited ionic liquid are employed, which may lead to safety/costs issues. The low ionic conductivity of these organic electrolyte/ionic liquid would also lead to inferior kinetics and decreased power density. By contrast, aqueous electrolytes, with low costs, environmental friendliness, and high ionic conductivity, can be adopted in Zn-based hybrid supercapacitors, which endow Zn-ion hybrid supercapacitors to be widely employed in practical/commercial applications, All these reasons prompted us to investigate Zn-ion hybrid supercapacitors.