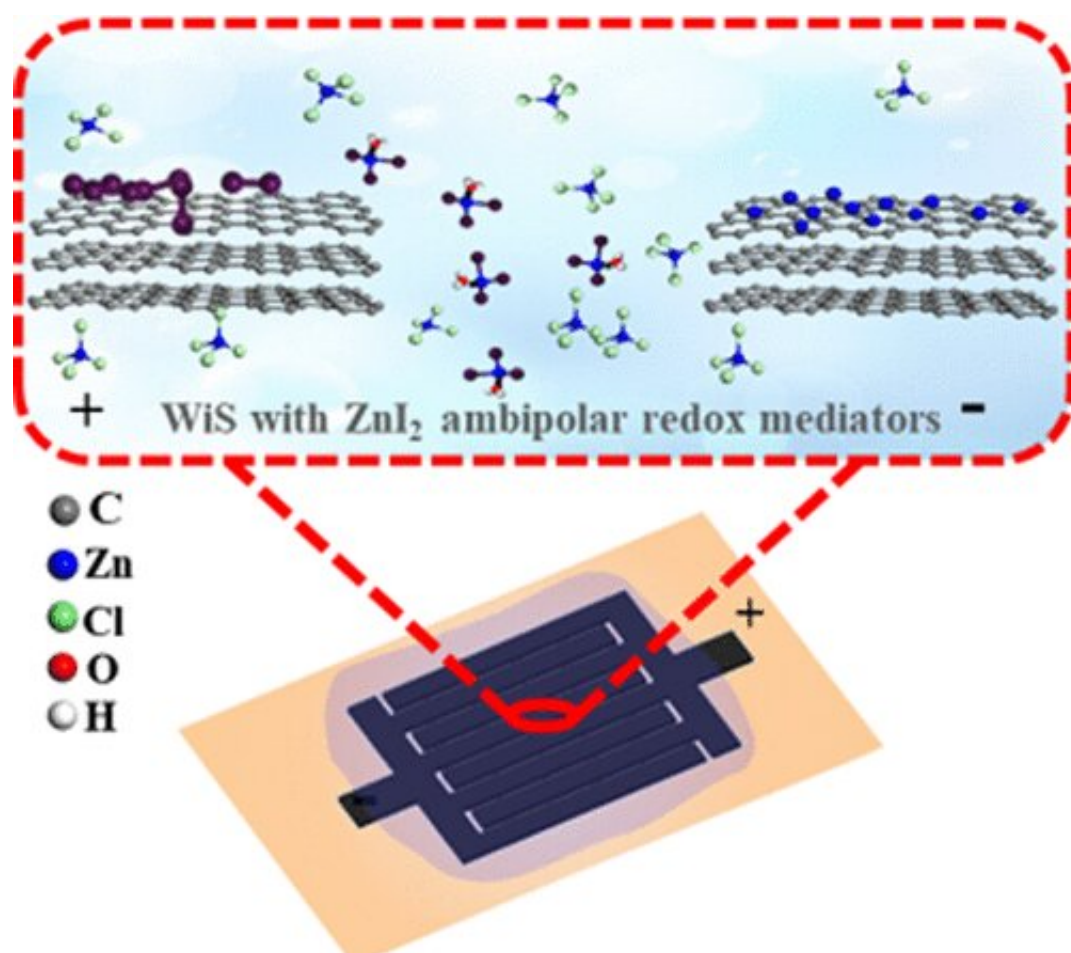


# New strategy to boost pseudocapacitive performance of micro-supercapacitors

April 28 2022, by Li Yuan



Graphical abstract. Credit: *ACS Energy Letters* (2022). DOI: 10.1021/acsenenergylett.2c00329

Graphene-based micro-supercapacitors (EG-MSCs) combine the distinct

properties of graphene and the advantages of planar device configuration to maximize charge storage. Therefore, they can provide more flexible, smaller, and thinner devices.

However, the limited electric double layer capacity of graphene and the narrow voltage window of aqueous electrolytes limit their further application.

Recently, a joint research team led by Prof. Wu Zhongshuai and Prof. Fu Qiang from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) has proposed a strategy for boosting the capacitance of graphene-based planar MSCs by highly concentrated water-in-salt ambipolar redox electrolyte ( $\text{ZnI}_2 + \text{ZnCl}_2$ ).

This study was published in *ACS Energy Letters* on April 19.

Using redox-active electrolytes to boost [graphene](#) electrodes is a highly-efficient strategy to increase the capacitive performance of MSCs.

However, previously reported redox mediators could only offer a certain capacitance for a single electrode, leading to limited energy density due to the unmatched capacitances of two electrodes.

In this study, the researchers developed a novel highly concentrated water-in-salt ambipolar redox [electrolyte](#) where one ambipolar mediator ( $\text{ZnI}_2$ ) could offer two redox couples ( $\text{I}^-/\text{I}_2$  and  $\text{Zn}/\text{Zn}^{2+}$ ) natively, with matched charge storage.

These two species allowed two electrons to be oxidized at the positive electrode and to be reduced at the negative electrode synchronously and individually, thus offering a large pseudocapacitive contribution for EG-MSCs.

They have realized high volumetric capacity of 106 mAh/cm<sup>3</sup>, [energy density](#) of 111 mWh/cm<sup>3</sup>, and long-term cycling stability with 92.1% retention after 5,300 cycles.

In situ characterizations confirmed that these good performances were attributed to the frustrated self-discharge by suppressing the formation and diffusion of polyiodide ions of I<sub>3</sub><sup>-</sup> and I<sub>5</sub><sup>-</sup>.

Moreover, EG-MSCs showed stable cycling performance at -20 degrees Celsius, owing to the reduced freezing point of water by [strong interactions](#) between [water molecules](#) and zinc ions.

"This work opens a new avenue of introducing ambipolar [redox](#) mediators into highly concentrated electrolytes for high-performance MSCs," said Prof. Wu.

**More information:** Caixia Meng et al, Water-in-Salt Ambipolar Redox Electrolyte Extraordinarily Boosting High Pseudocapacitive Performance of Micro-supercapacitors, *ACS Energy Letters* (2022). [DOI: 10.1021/acsenergylett.2c00329](https://doi.org/10.1021/acsenergylett.2c00329)

Provided by Chinese Academy of Sciences

Citation: New strategy to boost pseudocapacitive performance of micro-supercapacitors (2022, April 28) retrieved 10 July 2024 from <https://phys.org/news/2022-04-strategy-boost-pseudocapacitive-micro-supercapacitors.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.