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Editorial: Advanced electrode materials: towards high-performance battery electrodes via ingenious materials design and fabrication

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Editorial on the Research Topic

Advanced electrode materials: towards high-performance battery electrodes via ingenious materials design and fabrication

Innovative morphology and structural design in advanced electrode materials at the nanoscale scale provide tremendous promise to further the creation of high-performance electrodes. Due to capacity deterioration and insufficient energy densities, which prevent the practical adoption of these technologies in the future. The search for high-performance electrode materials for batteries other than Li-ion batteries remains difficult.

We appreciate all the authors and consider it a pleasure to have hosted this research subject on Advanced Electrode Materials: Towards High-Performance Battery Electrodes through Ingenious Materials Design and Fabrication. This study's objective is to give a comprehensive summary of current developments in smart nanostructured materials that have a big influence on the batteries operate behavior electrochemically. For high energy density and durable electrode materials, several workable electrode design strategies have been developed, primarily in terms of alloy nanostructure (Zeng et al.), porous materials (Li et al.), well-designed spinel anode (Wang et al.), as well as a review on the recent progress of two-dimensional (2D) metal tellurides electrodes (Guo et al.).

The well-designed nanostructured Cu-Al catalysts, which are made of Cu₂O modified by Al and prepared by a green microwave-assisted solvothermal process, can efficiently and selectively convert CO₂ to CO and HCOOH. At 1.0 and 1.3 V (vs. RHE), good current densities of 67 and 130 mA·cm⁻² are attained, respectively. When the electrolyte was changed to KOH, an impressive selectivity for C₂H₄ production was observed, as high as 20%, and the current densities reached 146 and 222 mA·cm⁻² at 1.0 and 1.3 V (vs. RHE), respectively. The

work suggested a method for producing Cu-Al materials that is economic friendly, ecologically friendly, and energy-efficient, enabling their mass manufacturing.

A type of Co/C material with a stable hollow structure that offers a lot of space for particle shrinkage and expansion was proposed for the electrodes in supercapacitors. The materials displayed outstanding specific capacitance ($400 \text{ F}\cdot\text{g}^{-1}$, $0.5 \text{ A}\cdot\text{g}^{-1}$) and stability (90%, 10,000 cycles). The electrochemical performance was strongly impacted by the various ratio concentrations in the structure. This research demonstrated that the carbon-based materials' ability to store energy was dependent on the interaction between their component and mesoporous structures.

The self-templating solvothermal approach was suggested to create rambutan-like $\text{Co}_{0.5}\text{Ni}_{0.5}\text{Fe}_2\text{O}_4$ for employing as an anode in high-performance Li-ion batteries. $\text{Co}_{0.5}\text{Ni}_{0.5}\text{Fe}_2\text{O}_4$, which was made by assembling many nanosheets, has a special chemical structure that makes it possible to efficiently buffer the volume change that happens while charging and discharging. The partial substitution of Ni in NiFe_2O_4 results in $\text{Co}_{0.5}\text{Ni}_{0.5}\text{Fe}_2\text{O}_4$, and it is expected that the cohabitation of nickel and cobalt would result in more efficient redox reactions. The rambutan-like $\text{Co}_{0.5}\text{Ni}_{0.5}\text{Fe}_2\text{O}_4$ anode material might have a specific capacity of $963 \text{ mA}\cdot\text{h}\cdot\text{g}^{-1}$ after 200 cycles at a current density of $500 \text{ mA}\cdot\text{g}^{-1}$. More metal oxide can be produced using this type of synthesis method, which will be used to develop potential Li-ion batteries anodes.

Finally, the exceptional physical and chemical benefits as well as their robust metallic characteristics make two-dimensional metal tellurides potential as electrodes. The fabrication of two-dimensional metal tellurides and their use in electrode materials have recently advanced. First, a summary of the most popular preparation techniques is provided, including aqueous/solvent thermal,

chemical vapor deposition, and electrodeposition. Following that, areas like electrocatalysis, lithium-sulfur batteries, lithium/sodium ion anode materials, and metal tellurides in supercapacitors are covered.

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Author contributions

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Conflict of interest

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