New synthesis method enhances the electrochemical performance of lithium sulfur batteries

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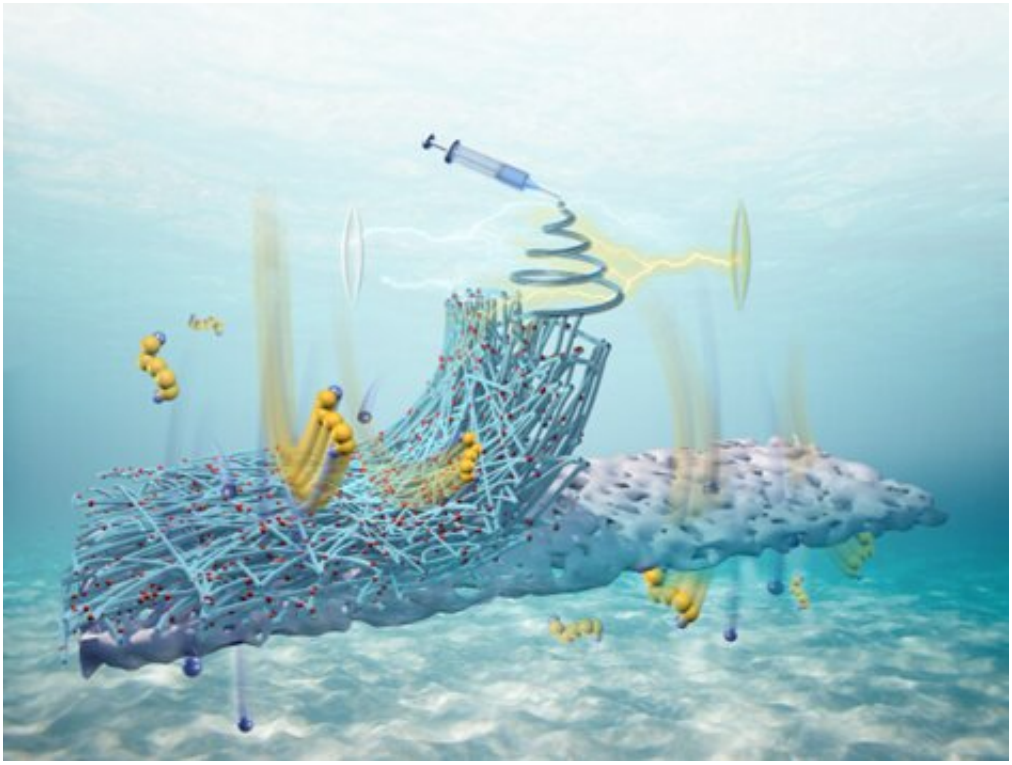

The bifunctional effect of grapevine-like high entropy oxide composites on lithium polysulfides. Credit: Zhengzhou University, China

The high energy and low cost features of lithium sulfur batteries (LSBs) have seen them become a promising energy storage technology for energy-intensive applications, such as portable devices and electric

vehicles.

However, their commercial applicability is hampered by hysteretic electrode reaction kinetics and the shuttle effect of lithium polysulfides (the diffusion back and forth of polysulfide between anode and cathode).

In a study published in the journal *Green Energy & Environment*, a group of researchers from China describe a bifunctional high entropy metal oxide/carbon nanofibers (HEO/CNFs) interlayer they have designed via a simple electrospinning approach for LSBs.

Dr. Yongzhu Fu, a professor at Zhengzhou University in China, explains that "the combination of polar metal oxide and high entropy-induced chemisorption effect can effectively reduce the shuttle and loss of polysulfides in the cathode side. In view of these advantages, designing an efficient and characteristic high entropy metal oxides interlayer is advantageous for LSBs."

Huarong Fan, a postgraduate student at Zhengzhou University, came up with the new method of synthesis and, according to Dr. Xin Wang, a professor at Zhengzhou University, the reason it works so well is that "the CNFs with highly porous networks provide transport pathways for Li^+ and e^-, as well as a physical sieve effect to limit lithium polysulfides (LiPSs) crossover. In particular, the grapevine-like HEO nanoparticles generate metal-sulfur bonds with LiPSs, efficiently anchoring active materials."

The unique structure and function of the interlayer give the LSBs superior electrochemical performance, i.e., the high specific capacity of 1381 mAh g^{-1} at 0.1 C and 561 mAh g^{-1} at 6 C.

According to Prof. Wang, "this work not only establishes an effective

way to prepare HEO interlayers for LSBs, but also contributes to the advancement of high entropy materials."

More information: Huarong Fan et al, Grapevine-like high entropy oxide composites boost high-performance lithium sulfur batteries as bifunctional interlayers, *Green Energy & Environment* (2022). DOI: 10.1016/j.gee.2022.11.001