New aqueous electrochemical energy storage battery could pave the way for grid-scale energy storage

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The typical structure of the $K_xFe_yMn_{1-y}[Fe(CN)_6]_w \cdot zH_2O$ in the P21/n space group. Credit: *Nature Energy* (2019). DOI: 10.1038/s41560-019-0388-0

A team of researchers with the Chinese Academy of Sciences has developed a new aqueous electrochemical energy storage battery that they believe could pave the way for grid-scale energy storage. In their paper published in the journal *Nature Energy*, the group describes how they built their new battery and how well it worked when tested. Lauren

Marbella with Columbia University has published a News and Views piece on the work done by the team in the same journal issue.

Researchers are exploring the use of renewable energy sources in large buildings—Marbella claims they contribute up to 30 percent of worldwide greenhouse gas emissions. While it is possible that they could simply use electricity generated in a remote location, it would be more economical to generate their own energy and store it onsite in batteries. The problem with this approach is that conventional batteries are highly flammable. In this new effort, the researchers have developed a type of battery that is capable of storing power from a renewable resource (such as a solar panel) without fire risk.

To come up with a less flammable battery, the researchers studied modified potassium-ion technology with water as an electrolyte. They wound up using a perylenetetracarboxylic diimide anode and a Prussian-blue "water-in-salt" cathode. The result was an aqueous potassium-ion battery with lower energy density than is needed for other applications, but which has much lower susceptibility to overheating and fire. In the end, they produced a 1.3-volt battery, which they note holds potential for optimization to increase the voltage while at the same time reducing costs.

The researchers overcame several challenges to make the batteries fire-resistant while maintaining their ability to store enough electricity to be useful and practical. One such problem was the limited stability of water, and another was the need to prevent structural degradation of the cathode due to the constant movement of potassium ions. Marbella notes that finding solutions to such problems required borrowing ideas from organic electronics, thermodynamics and materials science.

More information: Liwei Jiang et al. Building aqueous K-ion batteries for energy storage, *Nature Energy* (2019). DOI:

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