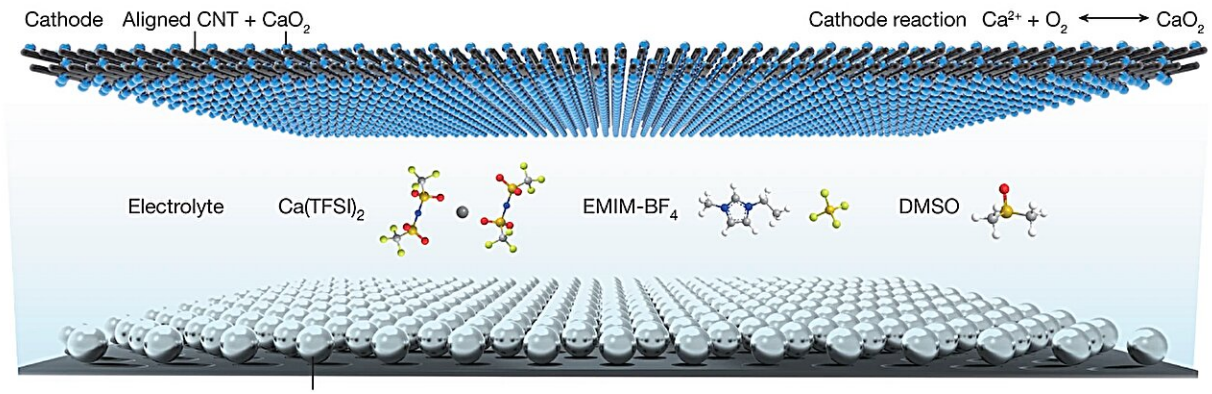
Engineers develop promising calcium-based battery that's rechargeable and operates at room temperature

February 20 2024, by Bob Yirka



Schematic of the rechargeable Ca–O_2 battery, with an aligned CNT sheet as cathode, Ca metal as anode and 0.5 M $Ca(TFSI)_2$ in $EMIM\text{-}BF_4$/DMSO (50:50 vol%) as electrolyte. On the cathode side, O_2 is reduced and combined with Ca^{2+} in the electrolyte to form CaO_2 during discharge, and the reverse reaction occurs during charge. On the anode side, metallic Ca is stripped during discharge and re-plated on recharge. Credit: *Nature* (2024). DOI: 10.1038/s41586-023-06949-x

A multi-institutional team of Chinese engineers has developed a proof-of-concept calcium-based battery that withstands 700 charge cycles at room temperature. In their paper published in the journal *Nature*, the group describes the challenges they addressed in developing the battery and what they have learned about the possible use of calcium-based batteries

in consumer products in the future.

The current standard for rechargeable batteries used in consumer products is lithium. But because it is a rare material and has issues such as poor aging and the need to prevent overcharge, scientists have been looking for a suitable replacement. One such material is calcium, which is 2,500 times as abundant as lithium.

Prior research has suggested rechargeable batteries based on calcium should be possible if problems can be resolved. One of the biggest challenges is finding suitable electrolyte and electrode materials that can provide stability and safety.

In this new effort, the researchers attempted to develop a useable, rechargeable, calcium–oxygen-based battery—prior research has suggested such pairings are likely to have the highest energy density of calcium-based batteries. Prior efforts to create batteries using this approach have run into problems with inactive discharge materials, and it has also been challenging to find electrolytes that can work with both calcium and oxygen.

To overcome these problems, the team in China created a new type of liquid electrolyte that works with both calcium and oxygen. This involved the use of a two-electron redox process and specific proportions of materials. The result was a battery that could be charged and recharged up to 700 times at room temperature.

The research team also incorporated their battery into flexible fibers which they wove into a textile, presenting the possibility of wearable consumer products. They acknowledge that the battery is still not efficient enough for use in commercial products, but they plan to continue their work to see if it can be improved.

More information: Lei Ye et al, A rechargeable calcium–oxygen battery that operates at room temperature, *Nature* (2024). DOI: 10.1038/s41586-023-06949-x

© 2024 Science X Network

Citation: Engineers develop promising calcium-based battery that's rechargeable and operates at room temperature (2024, February 20) retrieved 28 April 2024 from https://techxplore.com/news/2024-02-calcium-based-battery-rechargeable-room.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.