

Electrolytes for High Energy Density Ultracapacitors

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Technology Summary

ORNL researchers are developing a sodium-based electrolyte for ultracapacitors that has the potential to double their energy density. Ultracapacitors are used for applications such as storing energy from renewable sources, stabilizing the electrical grid, and providing bursts of power for lifting equipment and electric vehicles. They could be used in many more ways, but their applicability is constrained by their low energy density. The high-voltage electrolyte could lead to ultracapacitors that operate for much longer times, and small, lightweight ultracapacitors for devices such as phones and watches.

ORNL's innovation uses sodium salts dissolved in unconventional organic solvents. The new electrolyte is stable when cycled to 4 V and has higher thermal stability. The electrolyte currently used by most all ultracapacitors, in comparison, operates without deterioration at only up to ~2.7 V. Increasing the voltage window by even a small amount leads to a significant increase in energy density because an ultracapacitor's energy density increases quadratically with voltage.

Advantages

- Electrochemical potential window is ≥ 4 V for at least double the current energy density
- The salts and solvents are commercially available
- The process is cost-effective and scalable

Potential Applications

- Bursts of power for heavy lifting machinery
- Actuators in wind turbines
- Starting heavy diesel engines
- Uninterruptible power sources
- Mobile communications
- Remote sensors
- Actuators

Patent

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