Solid-state batteries chile

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With this research, the LESC - a collaboration between the UChicago Pritzker School of Molecular Engineering and the University of California San Diego"s Aiiso Yufeng Li Family Department of Chemical and Nano Engineering - has brought the reality of inexpensive, fast-charging, high-capacity batteries for electric vehicles and grid storage closer than ever.

"Although there have been previous sodium, solid-state, and anode-free batteries, no one has been able to successfully combine these three ideas until now," said UC San Diego PhD candidate Grayson Deysher, first author of a new paper outlining the team"s work.

The paper, published today in Nature Energy, demonstrates a new sodium battery architecture with stable cycling for several hundred cycles. By removing the anode and using inexpensive, abundant sodium instead of lithium, this new form of battery will be more affordable and environmentally friendly to produce. Through its innovative solid-state design, the battery also will be safe and powerful.

"To keep the United States running for one hour, we must produce one terawatt hour of energy," Meng said. "To accomplish our mission of decarbonizing our economy, we need several hundred terawatt hours of batteries. We need more batteries, and we need them fast."

Lithium deposits are also concentrated. The "Lithium Triangle" of Chile, Argentina and Bolivia holds more than 75% of the world"s lithium supply, with other deposits in Australia, North Carolina and Nevada. This benefits some nations over others in the decarbonization needed to fight climate change.

Lithium extraction is also environmentally damaging, whether from the industrial acids used to break down mining ore or the more common brine extraction that pumps massive amounts of water to the surface to dry.

Traditional batteries have an anode to store the ions while a battery is charging. While the battery is in use, the ions flow from the anode through an electrolyte to a current collector (cathode), powering devices and cars along the way.

Anode-free batteries remove the anode and store the ions on an electrochemical deposition of alkali metal directly on the current collector. This approach enables higher cell voltage, lower cell cost, and increased energy density, but brings its own challenges.

"In any anode-free battery there needs to be good contact between the electrolyte and the current collector," Deysher said. "This is typically very easy when using a liquid electrolyte, as the liquid can flow everywhere and wet every surface. A solid electrolyte cannot do this."

The team took a novel, innovative approach to this problem. Rather than using an electrolyte that surrounds the current collector, they created a current collector that surrounds the electrolyte.

During battery assembly the powder was densified under high pressure to form a solid current collector while maintaining a liquid-like contact with the electrolyte, enabling the low-cost and high-efficiency cycling that can push this game-changing technology forward.

"Sodium solid-state batteries are usually seen as a far-off-in-the-future technology, but we hope that this paper can invigorate more push into the sodium area by demonstrating that it can indeed work well, even better than the lithium version in some cases," Deysher said.

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