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Nan Li, Wenfei Wei, Keyu Xie, Jinwang Tan, Lin Zhang, Xiaodong Luo, Kai Yuan, Qiang Song, Hejun Li, Chao Shen, Emily M. Ryan, Ling Liu, Bingqing Wei. Suppressing Dendritic Lithium Formation Using Porous Media in Lithium Metal-Based Batteries. Nano Letters, 2018; 18 (3): 2067 DOI: 10.1021/acs.nanolett.8b00183 Jan Bitenc, Niklas Lindahl, Alen Vizintin, Muhammad E. Abdelhamid, Robert Dominko, Patrik Johansson. Concept and electrochemical mechanism of an Al metal anode â€' organic cathode battery. Energy Storage Materials, 2019; DOI: 10.1016/j.ensm.2019.07.033

Drawdown â€“ The Most Comprehensive Plan Ever Proposed to Reverse Global Warming edited by Paul Hawken Â©2017 by Project Drawdown ISBN 9780143130444

https://www.pocket-lint.com/gadgets/news/130380-future-batteriescoming-soon-charge-in-seconds-last-months-and-power-over-the-air

“Clean Energy + Battery Storage = Game Changer” from *Catalyst* by Union of Concerned Scientists, Vol. 19, Fall, 2019

Improving Battery Efficiency and Ecology -- 11/2019

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Introduction. The main problems with current batteries are: (1) they short circuit, (2) they do not hold enough energy to be 24/7 energy storage for applications like solar and wind and to have good charge ranges for electric cars**;** (3) they do not charge fast enough, and (4) they **(**the current lithium metal batteries**)** are toxic to manufacture and ecologically dispose. Â Possible solutions are: (1) reducing the cost of batteries to allow reliable distributed energy storage from solar and/or wind at MANY separate locations as well as huge central utilities, (2) aluminum batteries for large scale uses such as solar and wind, (3) refinement of lithium ion battery composition, (4) a special laser burned plastic that charges 50 times faster, (5) oxygen charging aluminum for a car range of 1,100 miles, and (6) batteries that can be charged with urine.

Problem with Lithium on Current Batteries. Present re-chargeable batteries used in smart phones and in electric cars are lithium metal batteries. Lithium metal batteries are even a fire hazard. Their performance is hampered by lithium dendrites, formations that look like tiny stalagmites made of lithium deposits. As a battery is being used, lithium ions collect on the anode. Over time, the lithium deposits become non-uniform, leading to the formations of these dendrites, which can cause the battery to short circuit.

Introducing a layer of porous material into the system could deter dendrites from collecting on the anode. Using mathematical modeling, the research team found that a porous material suppressed the initiation and growth of dendrites. The dendrites that did form were 75 percent shorter than those that formed in systems that lacked the porous membrane. To further prove the finding, the team fabricated a membrane made of tiny wires of porous silicon nitride that measured less than one millionth of a meter each. They then integrated this membrane into lithium metal cells in a battery and ran it for 3,000 hours. No dendrites grew.Â What's more, this principle may also extend to other battery systems, such as zinc- or potassium-based batteries.

Aluminum Batteries for Low Cost and Ecology A new concept for an aluminum battery has twice the energy density as previous versions, is made of abundant materials, and could lead to reduced production costs and environmental impact. The idea has potential for large scale applications, including storage of solar and wind energy. Using aluminum battery technology could offer several advantages, including a high theoretical energy density, and the fact that there already exists an established industry for its manufacturing and recycling. Compared with today's lithium-ion batteries, the researchers' new concept could result in markedly lower production costs. "The material costs and environmental impacts that we envisage from our new concept are much lower than what we see today, making them feasible for large scale usage, such as **solar cell parks, or storage of wind energy, for example**," says Patrik Johansson, Professor at the Department of Physics at Chalmers.
So far, there are no commercially available aluminum batteries, and even in the research world they are relatively new. The question is whether aluminum batteries could eventually replace lithium-ion batteries.
"Of course, we hope that they can. But above all, they can be complementary, ensuring that lithium-ion batteries are only used where strictly necessary. So far, aluminum batteries are only half as energy dense as lithium-ion batteries, but our long-term goal is to achieve the same energy density. There remains work to do with the electrolyte, and with developing better charging mechanisms, but aluminum is in principle a significantly better charge carrier than lithium, since it is multivalent -- which means every ion 'compensates' for several electrons. Furthermore, the batteries have the potential to be significantly less environmentally harmful," says Patrik Johansson.

Other New Batteries: A car has managed to drive 1,100 miles on a single battery charge. The secret to this super range is a type of battery technology called aluminum-air that uses oxygen from the air to fill its cathode. This makes it far lighter than liquid filled lithium-ion batteries to give car a far greater range.
Scientists at Rice University have made a breakthrough in microsupercapacitors. Currently, they are expensive to make but using lasers that could soon change.
By using lasers to burn electrode patterns into sheets of plastic, manufacturing costs and effort drop massively. The result is a battery that can charge 50 times faster than current batteries and discharge even slower than current supercapacitors. They're even tough, able to work after being bent over 10,000 times in testing.
Use the link**s** in the references to see many other new battery examples.
Power Japan Plus has already announced a new battery technology called Ryden dual carbon. Not only will it last longer and charge faster, but it can be made using the same factories where lithium batteries are built.
The Gates Foundation found cell phones that can be powered by urine. Using a Microbial Fuel Cell, micro-organisms take the urine, break it down and output electricity.

Need For More Research and Development. Lobbying for public and private research is needed to increase battery storage capacity, reduce cost, enhance safety and reduce environmental impacts. Several bi-partisan bills are pending in Congress to support research and development of battery technology