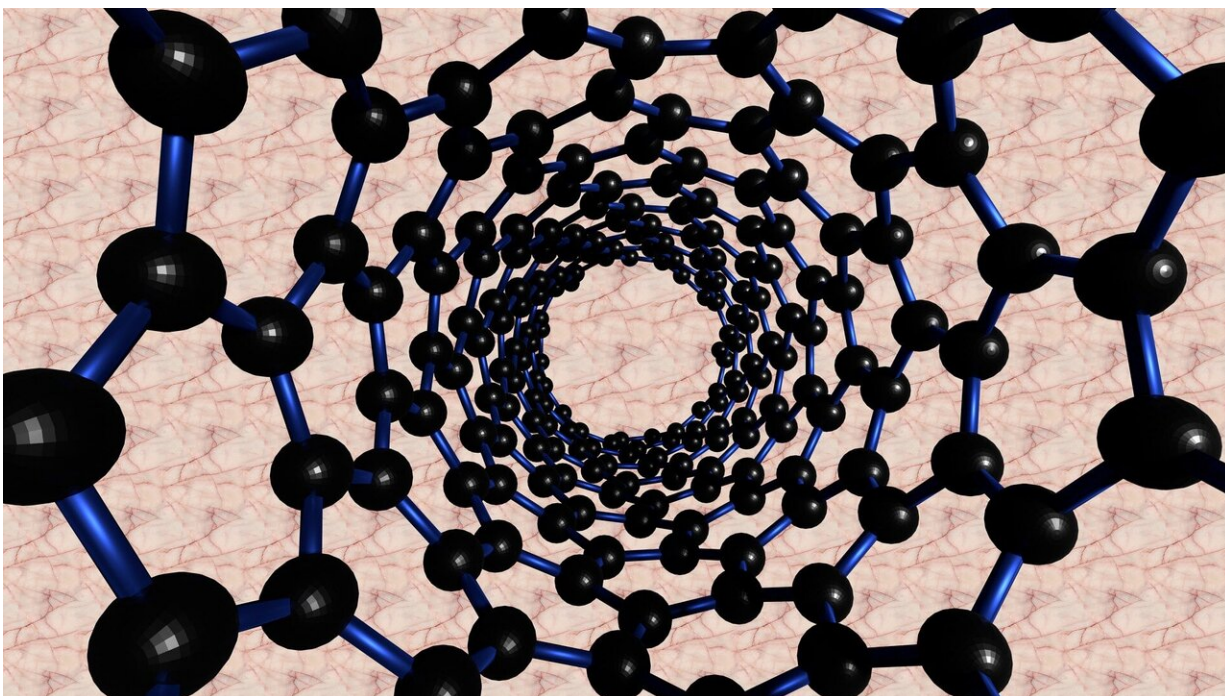


Nanotube-infused anode enables more efficient potassium-ion batteries

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A group of Skoltech scientists has been granted a patent for anodes with improved electrochemical characteristics based on non-graphitized, or hard carbon for potassium-ion batteries. This invention will help bring potassium-ion batteries closer to market as potential replacements for lithium-ion batteries, reducing the need for this costly and rare metal.

Skoltech Provost Keith Stevenson, Professor and Director of the Center for Energy Science and Technology (CEST) Artem Abakumov, research scientists Elena Abramova and Dmitry Rupasov, and Ph.D. students Natalia Katorova and Polina Morozova have developed the new anode composition for potassium-ion batteries, as existing solutions for lithium-ion battery anodes cannot be used in potassium-ion batteries. "The reason is a big difference in ionic radii of Li and K, so materials suitable for lithium intercalation are not appropriate for potassium-ion uses. Anodes based on [hard carbon](#) are convenient materials for K intercalation owing to its structure, and the easy way of synthesis is an additional advantage of hard carbon," Morozova says.

Since carbon nanotubes have extremely high electronic conductivity, which is very important for fast and durable battery operation, the authors combined carbon nanotubes and hard [carbon](#) to get good anodes. It also led to an increase in coulombic efficiency of the anode properties, calculated as the ratio of the total charge extracted from the battery to the total charge put into the battery over a full cycle. All these results show that this [anode](#) design is a good choice for further investigation.

"This invention will help in the development of potassium-ion batteries. Such anodes can be combined with cathode materials, suitable electrolytes, and can be implemented in the production of K-ion cells for energy storage systems," Morozova notes.

Provided by Skolkovo Institute of Science and Technology

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