Advanced Lithium-ion Battery that Self-assembles using Viral Particles
Technology #11332

Applications

Lithium-ion batteries have a high energy density and a long lifespan. As such, they are widely used in electronics that have heavy electrical demands (e.g., laptops, pacemakers, communication devices, etc.). They are also becoming a more popular battery choice for military, electric car, and aerospace applications. This advanced lithium-ion battery is flexible and ductile, and can thus be produced in various shapes and sizes to suit a variety of applications. It features enhanced charge capacity and structural stability compared to traditional lithium ion batteries, and is less expensive to produce.

Problem Addressed

Rechargeable, high energy density batteries are in demand due to the widespread and increasing use of portable electronic devices. Lithium-ion batteries are used most commonly due to their high performance, but are typically expensive to produce and often present safety risks. Various lithium-ion batteries have been generated, occasionally optimized for one aspect of performance over another (e.g., lower safety risk in exchange for decreased charge density). This advanced lithium-ion battery features an electrode composed of a cobalt oxide film. The film is assembled by bacteriophage (virus) particles and confers improved stability and capacity to the lithium-ion battery. It can be produced in a variety of shapes and sizes while retaining structural stability. Because the bacteriophage are easily reproduced in a bacterial host, it is also a cost-effective alternative to standard lithium-ion batteries.

Technology

Lithium-ion batteries are rechargeable batteries in which lithium ions move between an anode and a cathode. One of the electrodes is made of lithium plus an intercalated material (e.g., lithium / transition metal oxide). The properties of these intercalated materials determine the voltage, capacity, and stability of the battery, making them an important part of the optimization process. This lithium-ion battery features an electrode that is generated by bacteriophage particles. The bacteriophage is genetically engineered to express peptides that can bind various metal ions. Exposing the phage particles to metal ions results in bonds that facilitate the formation of metal oxide (e.g., cobalt oxide) nanowires. These nanowires form a patterned monolayer of cobalt oxide that is structurally supported by the bound viruses. The monolayer is “grown” on top of an electrolyte and can be patterned to take on a variety of shapes and sizes. The virus-based lithium-ion battery features increased capacity in addition to being lightweight, flexible, and transparent.

Advantages

- Low cost of production
- Enhanced performance
• Longer lifespan
• Self-assembly
• Can take on different shapes and sizes

Categories For This Invention:

Energy
Energy Storage
Batteries
Lithium Batteries

Intellectual Property:

Virus scaffold for self-assembled, flexible and light lithium battery
Issued US Patent
8,283,325
Virus scaffold for self-assembled, flexible and light lithium battery
Issued US Patent
9,559,360

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Publications:

Virus-Enabled Synthesis and Assembly of Nanowires for Lithium Ion Battery Electrodes
Science
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External Links:

Biomolecular Materials Group
http://belcherlab.mit.edu/

Image Gallery: