TECHNOLOGY

Nanopore Battery

OVERVIEW

Background:
For advances in electrical energy storage, nanostructuring of electrode materials using nanowire or nanotube configurations holds promise for higher available energy at any given power density, due to larger available surface area and shorter ion transport time of the electrode materials; and improved mechanical flexibility and durability as ions are incorporated and released during charge/discharge cycling. Power and energy metrics would be further improved if anode and cathode nanostructures in a battery or supercapacitor could be brought into close proximity in a full cell.

Innovation:
Researchers at the University of Maryland have developed a Nanopore Battery comprised of nanotubular electrodes and electrolyte confined within an anodic aluminum oxide nanopore as an “all-in-one” nanopore device. The all-in-one nanopore battery exhibits striking performance that conveys important messages about nanostructure design for high power electrochemical energy storage. In both half and full cells, capacity retention is excellent (~50% at 150C of 1C rate), providing 82mAh/g at 150C (24 sec charge/discharge time). Stability with charge/discharge cycling is also remarkable, with ~90% of initial capacity retained after 1000 cycles for rates 5-25C. Atomic layer deposition into nanopores enables the nanotubular electrode design, thin storage layers and integrated current collecting layers, facilitating fast ion and electron transportfor high power at high energy.

APPLICATIONS

Batteries with high power at high capacity for fast charge/discharge cycling
Benefits to transportation applications, particularly fast recharge, acceleration, and regenerative braking
Benefits to grid storage for power leveling of transients in supply and demand
Sensor/actuator systems requiring high burst power

ADVANTAGES

High power with high energy density
Excellent capacity retention with charge/discharge cycling

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Additional Information

INSTITUTION

University of Maryland, College Park

CATEGORIES

- Clean Tech
- Power Electronics
- Chemical
- Materials

EXTERNAL RESOURCES

- US Patent 10,032,569

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