

TECHNOLOGY FACT SHEET

BETTER PERFORMING LITHIUM/CARBON FLUORIDE BATTERY

(Zhang, Foster, Wolfenstine, Read)

Introduction

This invention demonstrates a substantial advance in high performance primary cell (non-rechargeable) battery technology. Researchers at the Army Research Laboratory-Sensors and Electron Devices Directorate (ARL-SEDD), Adelphi, Maryland developed and successfully tested a new method and materials that measurably improve the performance of lithium/carbon monofluoride (Li/CFx) batteries in a number of key areas as compared to similar cells on the market today.



Concept

ARL researchers envision this new technology being applied to existing product lines with little modification to current manufacturing processes. Benefits could be wide ranging. For example, consider the next generation of dynamic artificial pacemakers, such as the one shown above (**Source: Food and Drug Administration**). These devices attempt to mimic nature by utilizing various inputs (body temperature, dissolved blood oxygen, physical exertion, adrenaline, etc) to produce a sensitive and responsive heart rate, instead one that is predetermined and static. These units will require more capable, longer-lasting batteries, and the novel ARL approach could produce cells that go a long way to enable these and other new, compact devices that require power sources with better levels of performance.

Invention Overview

- ❖ Conserves up to 10 percent capacity by eliminating voltage delay common to other Li/CFx cells
- ❖ Method is simple to practice and ready for mass production
- ❖ Multiple applications wherever Li/CFx batteries are used today
- ❖ TRL 5 – Fully functioning prototype cell fabricated using ARL process
- ❖ Unpublished laboratory results available
- ❖ Provisional patent application filed 6/14/16, 923

Doing Business with ARL

- ❖ ARL-SEDD is a leader in partnering with domestic firms
- ❖ Successfully developed and implemented innovative tools to ease the technology transfer process
- ❖ Tools includes Patent License Agreements (PLAs); Cooperative Research and Development Agreements (CRADAs); Test Services Agreement (TSA); and others
- ❖ Visit www.arl.army.mil for more information

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Features/Capabilities/Intellectual Property

The Li/CFx cell is known to have one of the highest theoretical energy capacities compared to other popular lithium cell chemistries, such as Li/SOCl₂ and Li/MnO₂. Carbon monofluoride batteries have also offered excellent energy density, high-temperature performance, and long shelf life. However, these pluses are tempered by well-known drawbacks: (a) considerable voltage drop during the initial discharge period; (b) low discharge rate; and (c) unfavorable heat generation during discharge, particularly at higher rates. This ARL invention provides a method and materials for improving the capability of Li/CFx cells in several ways: (1) an elimination of or greatly reduced voltage drop during initial discharge; (2) superior energy density; (3) higher running voltage; and (4) increased discharge rate ceiling.

This invention is based on a novel composite cathode developed at ARL-SEDD. The cathode is an uncomplicated assembly featuring a CFx material, a special additive and conductive agent and a chemical binder. All materials are available commercially off-the-shelf (COTS). The ARL team has achieved proof-of-concept and reduced the invention to practice, with reproducible results.

Other features/capabilities/intellectual property offered by this invention include the following:

- Greater number of potential applications
- Cost comparable to existing Li/CFx cells
- No increased battery weight
- Straightforward production
- IP includes novel process and composition of matter

Potential Markets/Applications

Li/CFx batteries were among the first commercially successful lithium battery systems, and they are found in a wide range of low-to-medium current applications for medical, electronics, military and aerospace customers. Usual formats include coin, cylindrical and prismatic cells, as well as standard and custom battery packs. The ARL invention not only retains all the favorable aspects of traditional Li/CFx batteries, but its improved performance characteristics should expand potential applications in the estimated \$1.5 billion marketplace (2010 est):

- Automotive: Tire pressure monitoring systems Public Safety: Toll tags, emergency signal lights
- Utilities: Electric, water and gas smart meters
- Commerce: Powered credit cards
- Oil Industry: Down-drilling data logging and control systems

Key Advantages & Benefits

- ❖ Produces cells with greatly reduced voltage delay and higher running voltage
- ❖ Uses commonly-available materials of construction
- ❖ Cost is expected to be less than comparable to existing Li/CFx product lines
- ❖ Drop-in technology applicable to existing production lines
- ❖ Inventor team available to work with commercialization partner

Contact Information

This technology was developed by ARL-SEDD. It is now available for licensing and CRADA opportunities.

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