

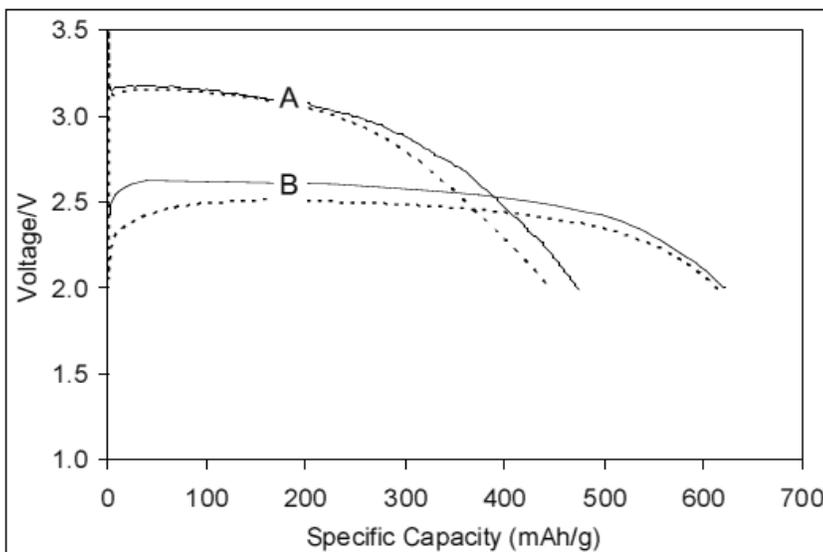
TECHNOLOGY FACT SHEET

HIGHER VOLTAGE LITHIUM-CARBON FLUORIDE BATTERY (Behl, Read)

Introduction

This invention demonstrates a substantial advance in lithium-carbon fluoride battery technology. Researchers at the Army Research Laboratory-Sensors and Electron Devices Directorate (ARL-SEDD) in Adelphi, Maryland developed and tested a new method for creating high performance carbon fluoride cathode materials for primary (non-rechargeable) batteries. The SEDD innovation can significantly reduce risks in CF_x manufacturing while improving performance over similar batteries on the market today.

Discharge Curves



Discharge performance of synthesized material (A) using process developed by ARL . B) commercial CF_x material (Image source: SEDD)

Concept

SEDD researchers envision this new technology being deployed in any application where Li/CF_x batteries are being utilized today in existing coin, cylindrical, prismatic and multi-pack formats. Current uses for Li/CF_x cells vary widely and include computer clocks, artificial cardiac pacemakers, field charging packs, portable personal electronics and unattended sensor systems. The higher running voltage resulting from the SEDD process will broaden the range of potential applications.

Invention Overview

- ❖ Eliminates the use of fluorine gas and hydrofluoric acid from the cell manufacturing process
- ❖ Method is simple to practice and adaptable for mass production
- ❖ Multiple applications wherever $Li-CF_x$ batteries are used today
- ❖ TRL 4 – Fully functioning prototype cell fabricated using ARL process
- ❖ Laboratory results contained in ARL presentation, “ CF_x synthesized using mechano-chemical techniques,” available on the web
- ❖ Provisional patent filed 10/10/2009

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

Manufacturing CF_x cathode materials involves the use of fluorine gas at high temperatures. Fluorine is highly toxic, corrosive, and can cause ignition of organic material on contact. One alternate technique utilizes hydrofluoric acid (HF) under ambient conditions, but this does little to reduce risks since HF is also highly corrosive and dangerous to handle. Moreover, there are a limited number of facilities in the US that manufacture CF_x materials.

This ARL invention provides a method and materials for eliminating the use of fluorine gas and HF, which results in a novel and improved CF_x material. The reactive milling process employed by ARL alters how fluorine is introduced into the carbon structure changing the batteries properties. As depicted in the graph, the ARL invented CF_x formulation (A) result is a 20% higher initial running voltage and a smaller voltage delay than the commercial CF_x preparation (B). Other features/capabilities/intellectual property offered by this invention include the following:

- Easily accessible materials of construction
- Cost comparable to existing Li/ CF_x cells
- Straightforward production, easily learned
- IP includes novel composition of matter and processes for separation of the resultant carbon fluoride; recycling the reaction by-products; and assembly of the cell using the separated carbon fluoride powder.

Potential Markets/Applications

Li/ CF_x batteries were among the first commercially successful lithium battery systems, and they are found in a wide range of low-to-medium current applications. The SEDD innovation not only retains all the favorable aspects of traditional Li/ CF_x batteries, but its improved performance characteristics could 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

Key Advantages & Benefits

- ❖ Produces cells with 20% higher initial running voltage with smaller voltage delay
- ❖ Uses commonly-available materials of construction
- ❖ Cost is expected to be comparable to existing Li/ CF_x product lines
- ❖ Wide variety of potential applications
- ❖ 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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