Air Force SBIR/STTR

Innovation

Air Force SBIR/STTR Innovation Story

SBIR Topic Number:
AF03-172

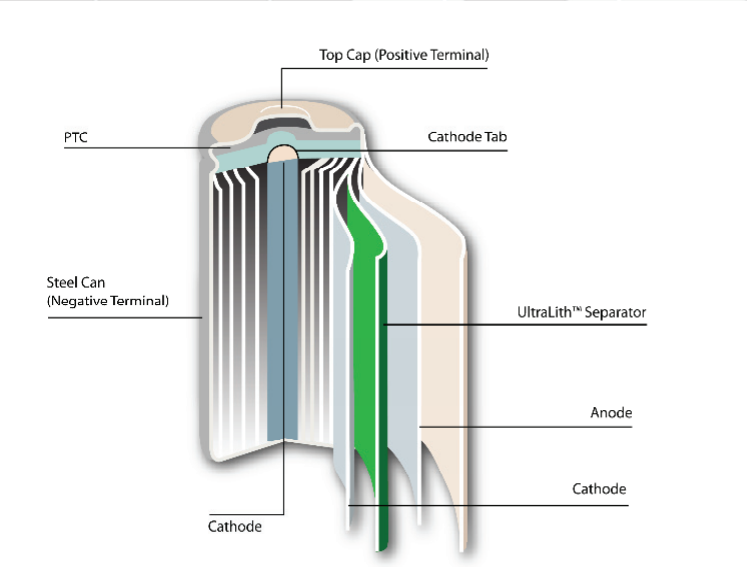
SBIR Title:
Advanced Separator Materials for Batteries

Contract Number:
FA8650-04-C-2480

SBIR Company Name:
Advanced Membrane Systems, Inc., North Billerica, MA

Technical Project Office:
AFRL Propulsion Directorate, Wright-Patterson AFB, OH

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



This illustration shows the battery separator and other components within a typical spiral wound lithium ion battery. The newly patented UltraLith-HP separator offers greater battery performance and improved safety – without the added cost of multiple layers or expensive coatings. It was engineered specifically to meet all current requirements for Electric Drive Vehicle applications.

Battery Separator Materials Manufacturer Opens New Facility

- The ultimate goal of the project was to qualify and commercialize new separator products and to provide the first viable U.S. source of separator material for nickel-hydrogen and other military and alkaline battery applications
- Advanced Membrane Systems, Inc. (AMS) developed a new separator product that was successfully tested in nickel hydrogen cells for military applications
- AMS' achievements during the Air Force SBIR project prompted a new Navy SBIR contract for AMS to develop a separator for lithium-ion battery applications
- The technology developed for this SBIR project has military applications and can also be used in a variety of commercial lithium primary and lithium-ion batteries such as those used in electric drive vehicles (EDV)

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Air Force Requirement

Battery separator material is an insulator that separates the positive and negative plates in a battery from each other while allowing the flow of ions. In essence, separators are a key component required for battery operation. The source of separator material for existing military and aerospace nickel-hydrogen batteries was planning to terminate its operation because of separator processing environmental control requirements that could not be met. A SBIR project was needed to develop a separator replacement capability that could not only re-establish a reliable supply source but also reduce the high cost, poor mechanical strength and environmental control implications associated with the current separator used in nickel-hydrogen batteries.

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SBIR Technology

Advanced Membrane Systems, Inc. (AMS) developed a new separator product that was successfully tested in nickel hydrogen cells for military applications. Recently, with some modifications of the separator originally developed for the U.S. Air Force, the technology also found applications in commercial alkaline batteries and has already been qualified for alkaline batteries for medical devices. AMS' achievements during the Air Force SBIR project prompted a new Navy SBIR contract for AMS to develop a separator for lithium-ion battery applications.

Technology for nickel hydrogen and alkaline battery separator: During the Air Force SBIR project, the AMS approach for meeting all of the separator requirements was to produce highly porous membranes that were inherently wetable in aqueous and alkaline solutions and in two different thicknesses, one in the range of 0.007 to 0.008 inch and the other 0.0025 to 0.0035 inch thickness for comparison and testing. The Phase II goal was to produce separator material and test the new separator in nickel hydrogen cells. The new AMS separator (called FAS) was successfully tested in cells by a U.S. military contractor for satellite battery applications and a roll of this separator was also submitted for a life test.

Technology for lithium primary and secondary lithium-ion battery separator: In the subsequent SBIR project sponsored by the Navy, the AMS goal was to develop separator products that met the performance, safety and cost requirements of both primary and secondary lithium-ion batteries. AMS developed two innovative battery separators.

- UltraLith-SD: a shutdown separator for high energy primary and secondary lithium-ion battery applications.
- UltraLith-HP: a non-shutdown separator for high power and high-density lithium-ion batteries needed for electric drive and other commercial/military applications that require higher temperature melt integrity, better performance and added safety features.

AMS produced prototype samples of UltraLith-SD and UltraLith-HP that met the preliminary requirements for both military and commercial use. The samples were sent to a military contractor for evaluation and cell testing. Both separators passed the initial cell tests in subcontractors' lithium primary cells. AMS will be producing new separator materials for further evaluation and qualification.

Potential Application

The technology developed for this SBIR project has applications not only for military but also in a variety of commercial lithium primary and lithium-ion batteries such as those used in electric drive vehicles (EDV). This has encouraged AMS to set up a production line for lithium-ion battery separator material in North Carolina. Moreover, in addition to primary lithium cells, several U.S. military battery companies as well as commercial domestic lithium-ion battery companies requested samples of the AMS separators for cell testing and evaluation.

Company Impact

AMS has been involved in innovative research and development of battery separator and materials technology for green energy since 2000. AMS separators are designed to surpass the performance, safety and cost requirements of alternative lithium-ion battery (LIB) separator products. AMS recently entered into a joint venture with Biax-Labs of North Carolina, founded a new company (called UltraLith LLC) and is setting up a manufacturing facility to produce lithium-ion battery separators. After decades, the AMS joint venture company, UltraLith LLC, is poised as a domestic advanced separator supplier to meet the existing and future U.S. military and domestic commercial separator demands. The above two SBIR projects and a United States Advanced Battery Consortium (USABC) grant were key in helping AMS to develop this technology.

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