Department of the Navy SBIR/STTR Transition Program

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NAVAIR

Topic # N18A-T008

Additive Manufacturing for Li-Ion Batteries (Phase II)

Physical Sciences Inc.

WHO

SYSCOM: NAVAIR

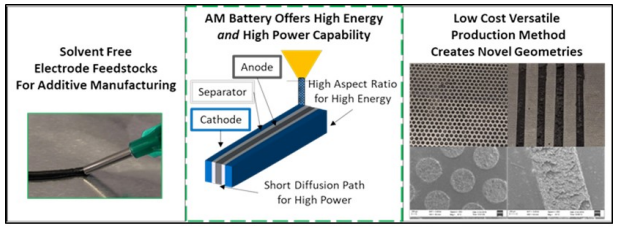
Sponsoring Program: PMA 275

Transition Target:

TPOC:

Other transition opportunities:
Navy to power next generation electronic equipment and vehicles.

Notes:
Imperia's processing techniques for solvent-free production of high performance lithium-ion components:
· Reduce manufacturing cost
· Eliminate waste
· Can enable production of complex geometries such as interdigitated electrodes
· Increase cell architecture design versatility



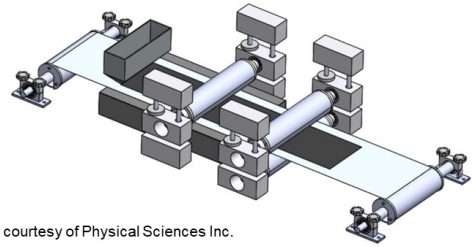


Image courtesy of Physical Sciences Inc.

Direct from powder scale up system: Powder is deposited and spread to the targeted loading before compression into the final electrode

Manufacturing processes could be used to produce higher performance batteries for all Navy and DOD applications. Current cells are being built to demonstrate the advantages and ability to use as a drop in replacement for traditionally produced components.

WHAT

Operational Need and Improvement:
Current electrode processing techniques require significant solvent quantities and cells can only be created using electrode stacking or rolling.

Specifications Required:
· Compatible with traditional and next generation materials.
· Insertable into current manufacturing lines.
· Reduced cost and environmental impact.
· Increased energy and power performance.
· Increased design flexibility.

Technology Developed:
Imperia has developed novel, high performance solvent-free Li-ion electrodes that enable production using Additive Manufacturing.
· Solvent-free processing reduces manufacturing cost by eliminating processing solvent and reducing electrode scrap.
· Electrodes are produced directly from powder and deliver improved power performance at high loading when compared to conventional electrodes.

Warfighter Value:
· The technology will enable rapid, scalable additive manufacturing production of high energy and power density lithium-ion batteries.
· The solvent-free manufacturing approach will decrease manufacturing costs, increase manufacturing throughput, and improve battery performance.
· Enable production of lithium-ion batteries that have both high energy and power characteristics improving versatility and simplifying design choices.

WHEN

Contract Number: N68335-19-C-0549 **Ending on:** December 20, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Produce solvent-free electrodes and integrate into a planar full cell.	N/A	Construction of functioning cells	3	December 2019
Produce solvent-free electrodes that demonstrate individually equivalent performance to traditional counterparts.	N/A	Electrochemical testing in conventional formats.	4	January 2020
Production process scale-up and pouch cell demonstration.	N/A	Demonstration of basic cell performance.	4	September 2020
Construction of roll-to-roll component production equipment.	N/A	Equipment constructed and validated to perform as designed.	5	April 2021
Full scale cell integration and performance demonstration.	Med	Demonstrate performance of the produced cells delivers the targeted energy and power density.	5	October 2021

HOW

Projected Business Model:
PSI's Imperia Batteries division operates a dedicated battery manufacturing facility in Wilmington, MA capable of producing ~1MWh of specialty Li-ion batteries per year. At this facility, Imperia produces specialty Li-ion batteries for PSI's small unmanned aerial systems (sUAS) that are being used in ongoing OCONUS military operations. Imperia brand batteries are tailored specifically to provide an optimum combination of battery performance by balancing energy density, power density, cycle life, safety, and cost. As a domestic ISO 9001 certified supplier, we provide a traceable and verifiable manufacturing process. This ensures that each cell and battery is manufactured with known test chemicals and verified processes. We are committed to working with our customers to deliver custom high performance energy storage solutions for their applications. The objective is to use the solvent-free manufacturing techniques to design, fabricate and deliver safe, high energy and power storage solutions for DOD customers.

Company Objectives:
PSI develops advanced technologies and products for the military, aerospace, industrial process, energy, telecommunications, environmental, and medical markets. PSI is strongly committed to developing products and services based on innovative technologies to support the missions of the Department of Defense. The mission of the Imperia Batteries division is to design, fabricate and deliver safe, high energy and power storage solutions for DOD customers.

Potential Commercial Applications:
This technology could be used to manufacture lower cost, higher performance batteries for use in:
· Consumer devices such as cell phones and laptops
· Electric vehicles
· High power laser systems
· Unmanned Aerial Vehicles (UAVs).

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