

Department of the Navy SBIR/STTR Transition Program

Statement A: Approved for Release. Distribution is unlimited.

Topic # N101-056

Compact and/or MEMS-based gas-sampling sensors for analysis of battery offgassing
NexTech Materials, Ltd. DBA Nexceris, LLC

WHO

SYSCOM: NAVSEA

Sponsoring Program: Team Ships, PMS 407

Transition Target: In-Service DDG 51 FLT IIA Class of ships

TPOC:
(215) 897-1413

Other transition opportunities:

This technology is applicable to all military applications using lithium ion battery based systems for primary and/or auxiliary power. Surface, submarine and UUV opportunities have been discussed with the Navy.

Notes: Nexceris, LLC was formerly known as NexTech Materials, Ltd.



Copyright 2015, Nexceris Off-gas Sensor Prototype

WHAT

Operational Need and Improvement: Batteries are critical to a number of existing and emerging power systems in naval vessels, including directed energy weapons systems, emergency back-up power in critical ship-service operations, start-up and load-leveling when used in conjunction with high-efficiency power generation systems, and motive power for unmanned underwater vehicles. Over-charged, degraded, or damaged Li-ion batteries emit hazardous gases that can cause explosions if left unchecked. Current battery monitoring methods, such as temperature and voltage, are often insufficient for detecting battery offgassing failures with sufficient time to take mitigating action. Better measurement tools are needed to protect Navy personnel and assets from potential fires and damage caused by lithium ion battery offgassing.

Specifications Required: (1) Detection of Li-ion battery electrolytes and their decomposition products; (2) Low cross-sensitivity to paint fumes, diesel fumes and other gases found on ships in addition to HF which is a potential byproduct of cell failure; (3) Robust to ambient conditions: 40 to 140 °F, 10 to 95% RH; (4) Response time: < 18 seconds response Recovery time: < 1 minute; (5) Audible and visual indicators; (6) 0 to 5VDC output signal; (7) Standard controls with Ethernet UDP communication; (8) 24VAC input power; (9) Robust to vibration, shock, and salt fog, demonstrated to appropriate MIL standards; (10) Weight: < 900g, Size: < 6 inches in any dimension

Technology Developed: Nexceris' ceramic-based gas sensor technology rapidly detects flammable gases emitted from damaged and degraded batteries. The sensors are integrated with an electronic controller to provide a complete monitor for the battery system. The monitoring system provides additional situational awareness of the condition of the batteries and can alert or take other action in response to a potential safety issue.

Warfighter Value: The Navy is exploring the deployment of lithium ion batteries for a number of weapons and other auxiliary power needs on ships and submarines. Lithium ion batteries, when damaged, can release flammable and toxic gases. Our technology provides early warning of these gases, allowing the warfighter to take mitigating action, protecting human life and assets.

WHEN

Contract Number: N00024-15-C-4002 **Ending on:** December 14, 2016

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Submitted specification document	Low	Specifications, validation methods, document; approved TPOC	5	March 2015
Preliminary product design	Low	Package submitted; approved PDR	5	August 2015
Preliminary field testing	Med	Prototype systems operated on a Navy ship, data analysis completed	5	March 2016
Final product design	Med	Package submitted; approved CDR	5	May 2016
Field testing completed	High	Test completed, test report submitted	6	December 2016

HOW

Projected Business Model: Nexceris will manufacture and sell systems directly to the Navy, as well as to commercial customers. Nexceris currently manufactures a hydrogen safety sensor, which it commercialized in 2010. The lithium ion battery off-gas sensor being developed for the Navy employs this same platform and will integrate seamlessly with Nexceris' production operations. Additionally, we have sales channels under our NTM Sensors division, including our website and distributors, which we will leverage to market and sell sensors commercially. Alternatively, for some applications, our direct customer will be the battery system integrator. For these applications, we will establish appropriate supply contracts to sell systems to these customers.

Company Objectives: Nexceris focuses its materials science expertise on creating innovative products that improve the quality, efficiency, and safety of energy and environmental systems, while providing maximum value to our customers. The lithium ion battery off-gas sensor being developed on this project fits squarely in that vision. Our goal is to commercialize battery off-gas sensors and monitoring systems for military and commercial applications, both stationary and mobile.

Potential Commercial Applications: Target applications are large lithium ion battery powered systems. Military applications include naval vessels, including directed energy weapons systems, emergency back-up power in critical ship-service operations, start-up and load-leveling when used in conjunction with high-efficiency power generation systems, and motive power for unmanned underwater vehicles. Commercial applications include marine applications (generally for auxiliary power systems), stationary distributed energy storage systems, electric vehicles, and battery back-up systems (such as in data centers and telecom towers).

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