

Department of the Navy SBIR/STTR Transition Program

STATEMENT A. Approved for public release; distribution is unlimited. ONR

Approval # 43-1256-16

Topic # N121-095

Development and Processing of Dielectric Films for Application in Large Wound Capacitors

PolyK Technologies, LLC

WHO

SYSCOM: ONR

Sponsoring Program: ONR Code 33 - Sea Warfare and Weapons

Transition Target: DDG-1000

TPOC:

Dr. Paul Armistead

paul.armistead@navy.mil

Other transition opportunities:

Pulsed power systems such as the Electromagnetic Railgun (EM Railgun) Innovative Naval Prototype (INP)

Electromagnetic launch systems

High power laser and microwave systems



Copyright, 2015, PolyK Technologies, LLC

WHAT

Operational Need and Improvement: Large-size film capacitors are critical component in many Navy pulsed power (EM Railgun) and power conditioning systems. They contribute a significant fraction of cost, volume, and weight to Navy operational systems. Bi-axially oriented polypropylene (BOPP) film capacitors are currently used by the Navy in some applications. The PolyK film capacitor offers advantages over BOPP with higher power densities (allowing use of fewer capacitors) and higher operating temperatures.

Specifications Required: There are two main specifications

1) The PolyK film capacitor needs to operate at 125 deg C ambient under continuous high power operation.

2) It will be highly desirable if the capacitor can provide energy density that is 100% higher than state-of-the-art BOPP capacitors, therefore, reducing the capacitor size by 50%.

Technology Developed: This SBIR Phase II project is for developing capacitor film with high dielectric constant (>4.5), low dielectric loss ($<1\%$), and high operation temperature (>125 C). The technology includes both high performance dielectric material formulations and advanced capacitor film manufacturing process. This will potentially meet the Navy specifications to achieve high energy density (100% higher than BOPP) and high operation temperature (125 deg C).

Warfighter Value: The new advanced direct current (DC) link film capacitors will enable the miniaturization of Navy power systems and improve their reliability, allowing them to operate at higher temperatures for longer periods of time.

WHEN

Contract Number: N00014-13-C-0234 **Ending on:** March 31, 2016

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Dielectric Composition Optimization	Med	Achieve balanced performance	3	December 2014
Capacitor Film Production Feasibility	Med	Demonstration of stretching capability	4	December 2014
Pilot Scale Capacitor Film Production	High	Production of large rolls of high quality ultrathin capacitor film	5	March 2016
Produce Prototype Capacitors	Med	Large size wound film capacitors	5	March 2016

HOW

Projected Business Model: PolyK will develop the new dielectric compositions and pilot scale manufacturing technologies. A pilot production facility is under development with the objective to produce up to 10,000 lbs of high quality capacitor film per year, and high energy density film capacitors with size of 1,000 uF per unit for high temperature applications. The pilot production facility shall be able to meet Navy needs for its electric ship program. If another large commercial market becomes feasible during the process, such as HEV, PolyK will license this technology to a larger company which can invest \$10M to build larger production lines.

Company Objectives: As there are many different electrical components on an electric ship and they may have totally different requirement on voltage, capacitance, operation frequency, power, etc on capacitors, PolyK would like to learn more details about potential Navy applications so it can design capacitors specially for one most feasible application to facilitate more meaning evaluation. PolyK is also interested in teaming with Prime contractors to jointly develop this technology. Furthermore, PolyK needs to continuously look for additional manufacturing funding to improve its pilot scale manufacturing facilities, such as a pilot scale transverse direction orientation machine (TD) and thin film winders with a budget of approximately \$3M.

Potential Commercial Applications: DC bus capacitors for hybrid electric vehicles, medical defibrillators, power conditioning capacitors for wind turbine generators, photovoltaics, high speed trains, etc.

Contact: Shihai Zhang, CEO

energy@polyktech.com

518-605-6897