Topic: N15A-T010

Vacuum Process Engineering, Inc.

Nanocomposite Scandate Tungsten Powder for High Current Density and Long Life Thermionic Cathodes
Vacuum Process Engineering, Inc. has over 40 years of experience in precision brazing, diffusion bonding, heat treating, thin film coating and contract manufacturing services. We are currently developing a large scale Scandate Tungsten Nanocomposite production facility to provide high-quality advanced thermionic cathode material to the US vacuum electronics industry enabling the development of any high-performance radar and electronic warfare systems reliant on advanced vacuum electron devices. Our product is capable of significantly improved emission characteristics at lower temperatures and with longer lifetimes than commercially available cathodes and VPE has already produced high-quality material with a threefold increase in production. Our goal is to supply sintered STN pellets to cathode manufacturers in order to manifest the next generation of advanced vacuum electronic devices.

Technology Category Alignment:

Electronic Materials
RF Components for sensing, transmission and communication
Manufacturing Technology for Affordability
Radio Frequency (RF) (non-EW)
Sensors, Electronics and Photonics

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SYSCOM: NAVSEA
Contract: N00253-17-C-0013
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00253-17-C-0013

Department of the Navy SBIR/STTR Transition Program

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NAVSEA ##2018-0492

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Nanocomposite Scandate Tungsten Powder for High Current Density and Long Life Thermionic Cathodes
Vacuum Process Engineering, Inc.

WHO

SYSCOM: NAVSEA

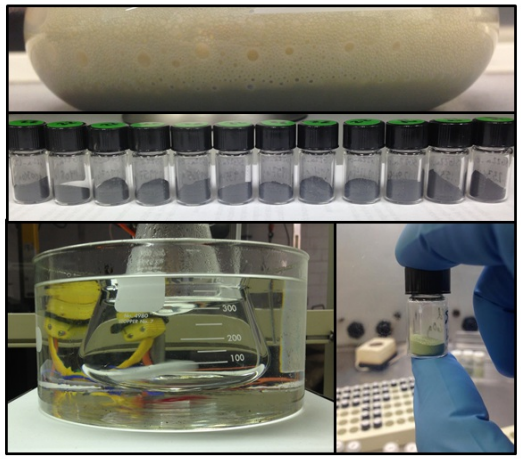
Sponsoring Program: PEO IWS 2.0

Transition Target: Radar Systems

TPOC:
(812)854-5264

Other transition opportunities: Traveling Wave Tubes, Klystrons, Magnetrons, Inductive Output Tubes, Satellite Communication tubes, Medical Imaging systems, Security Imaging systems.

Notes: Vacuum Process Engineering, Inc. (VPE) has built upon the work of our colleagues at UC Davis to create a production facility capable of meeting the material demands of the U.S. Navy and commercial customers for high current density and long life thermionic cathodes with Scandate Tungsten Nanocomposite (STN) material. VPE has decades of experience in advanced thermal processing and designing innovative manufacturing processes to bring R&D prototypes into viable full-scale production processes.



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WHAT

Operational Need and Improvement: Compact millimeter wave sources for future Radar and Electronic Warfare systems require microwave vacuum electron devices that exceed current standard cathode technology. Cathodes developed with STN material have demonstrated the capacity to meet or exceed these needs, and the teams at VPE and University of California (UC) Davis have developed the manufacturing capability for the increased volume necessary to sustain this burgeoning market.

Specifications Required: STN powder used to create dispenser cathodes will meet the performance metrics designated by industrial and government laboratory partners. These performance metrics will likely include, but are not limited to, improved current density and lifetimes at lower operational temperatures when compared with other commercially available cathodes: this validation process will ensure broad confidence in the reliability of this technology for use in other cutting edge projects.

Technology Developed: VPE is developing a large scale STN production line capable of manufacturing 2 - 10 kg of high current density and long-life dispenser cathode material which is qualified by third parties. This capability will include a carefully tailored set of processing variables and the necessary traceability to ensure each batch of material produced at our facilities will meet or exceed the needs of our customers.

Warfighter Value: This cathode technology provides an opportunity for vacuum electronics systems to leverage designs that are smaller, more resource efficient and that require less maintenance over their lifespans than current technology permits. Additionally, cathodes made with STN material are capable of extending the range of usable frequency necessary for rapid information transmission due to considerably improved current density.

WHEN

Contract Number: N00253-17-C-0013 **Ending on:** July 31, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Build a Small Scale Production Line at VPE	Low	Reproducible High Quality Emission Test Results	MRL-4	July 2018
Build a Large Scale Production Line at VPE	Med	Reproducible High Quality Emission Test Results	MRL-5	July 2019
Produce Set of Standard Pellets	Low	Set of pellets with variable dimensions and Sc % characterized	MRL-5	July 2019
Deliver Test Pellets to Collaborators	Med	Pellets sent to collaborators, and performance data returned	MRL-5	August 2019
Produce 10 kg of STN Powder	Low	10 kg of STN powder that meets QA standards	MRL-6/7	July 2020

HOW

Projected Business Model: Vacuum Process Engineering, Inc. is cultivating collaborative partnerships with numerous 3rd party laboratories that have offered to qualify STN material independently. As this project matures, these relationships will provide a basis for us to be come part of the cathode industry supply chain with the expectation that the cathodes made from VPE STN material will reliably outperform conventional cathodes.

Company Objectives: Vacuum Process Engineering, Inc. has over 40 years of experience in precision brazing, diffusion bonding, heat treating and contract manufacturing services. VPE has used this experience to characterize the STN powder production process precisely and will leverage this knowledge to continue producing high quality material at volumes necessary to supply the U.S. domestic vacuum electronics industry.

Potential Commercial Applications: Any vacuum electronics device or technology that relies on thermionic dispenser cathodes are likely to benefit from the advantages offered by our STN product. Some of these industries include ion thrusters, thermionic generators, scanning electron microscope sources, electron beam lithography, electron beam welding, electron beam machining, and food sterilization.

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