XI.0 Small Business Innovation Research (SBIR) Fuel Cell Technologies Office New Projects Awarded in FY 2016

The Small Business Innovation Research (SBIR) program provides small businesses with opportunities to participate in DOE research activities by exploring new and innovative approaches to achieve research and development (R&D) objectives. The funds set aside for SBIR projects are used to support an annual competition for Phase I awards of up to $225,000 each for about nine months to explore the feasibility of innovative concepts. Phase II R&D efforts further demonstrate the technologies to move them into the marketplace, and these awards are up to $1,500,000 over a two-year period. Small Business Technology Transfer (STTR) projects include substantial (at least 30%) cooperative research collaboration between the small business and a non-profit research institution.

Tables 1 and 2 list the SBIR Phase I and Phase II projects awarded in Fiscal Year (FY) 2016 related to the Hydrogen and Fuel Cells Program, respectively, followed by brief descriptions of each project.

TABLE 1. FY 2016 SBIR Phase I Projects Related to the Hydrogen and Fuel Cells Program

	Title	Company	City, State
XI.1	Development of Low Cost Magnetocaloric Nanomaterials for Sub 80 K Refrigeration Applications[1]	General Engineering & Research, LLC	San Diego, CA
XI.2	Development of Next-Generation Magnetocaloric Materials	Nanohmics, Inc.	Austin, TX
XI.3	High Charge Density Hydrocarbon-Based PEMs[2]	Giner, Inc.	Newton, MA
XI.4	Novel Hydrocarbon Ionomers for Durable Proton Exchange Membranes[2]	NanoSonic, Inc.	Pembroke, VA
XI.5	Novel Nanocomposite Polymer Electrolyte Membranes for Fuel Cells[2]	NEI Corporation	Somerset, NJ
XI.6	Low-Cost Proton Conducting Membranes for PEM Fuel Cells[2]	Amsen Technologies LLC	Tucson, AZ

TABLE 2. FY 2016 SBIR Phase II Projects Related to the Hydrogen and Fuel Cells Program

	Title	Company	City, State
XI.7	Cross-Polarized Near-UV/Vis Detector for In-line Quality Control of PEM Materials[3]	Mainstream Engineering Corporation	Rockledge, FL
XI.8	Hydrogen Contamination Detection[3]	Sustainable Innovations, LLC	Hartford, CT
XI.9	Regenerative Fuel Cell System[2]	PH Matter, LLC	Columbus, OH
XI.10	Economical Production of Hydrogen Through Development of Novel, High Efficiency Electrocatalysts for Alkaline Membrane Electrolysis[2]	Proton Energy Systems	Wallingford, CT
XI.11	Diode Laser Sensor for Contaminants in Hydrogen Fuel[2]	Southwest Sciences, Inc.	Santa Fe, NM

[1] STTR Projects
[2] Funded under the Basic Energy Sciences (BES) Office
[3] Technology Transfer Opportunity (TTO) Projects

PHASE I PROJECTS

XI.1 Development of Low Cost Magnetocaloric Nanomaterials for Sub 80 K Refrigeration Applications

General Engineering & Research, LLC
10459 Roselle Street, Suite A
San Diego, CA 92121

The energy consumption of liquefaction is a major contributor to the cost of hydrogen fuel. This project aims to develop a low cost magnetocaloric material for sub 80 K refrigeration applications. Most magnetocaloric materials in use today are high in cost because they use rare earth metals, such as gadolinium. This project will synthesize and characterize novel materials that avoid rare earth metals and have demonstrated potential in previous research.

XI.2 Development of Next-Generation Magnetocaloric Materials

Nanohmics, Inc.
6201 E Oltorf Street, Suite 400
Austin, TX 78741

This project will design next-generation technologies to cool hydrogen from room temperature by leveraging both the magnetocaloric and magnetoelastic effects in known magnetocaloric materials. The team will leverage their capabilities in nanofabrication to develop and demonstrate materials with geometries that maximize these effects.

XI.3 High Charge Density Hydrocarbon-Based PEMs

Giner, Inc.
89 Rumford Avenue
Newton, MA 02466

This project will develop novel hydrocarbon-based ionomeric membranes with high conductivity and mechanical strength for use in low relative humidity, high temperature fuel cell applications. Giner's proven Dimensionally Stable Membrane technology will be used to further increase the strength of the membranes and increase resistance to creep at high temperatures. The end product of this project will be a less expensive, viable alternative to perfluorosulfonic acid for use in automotive fuel cells and other applications.

XI.4 Novel Hydrocarbon Ionomers for Durable Proton Exchange Membranes

NanoSonic, Inc.
158 Wheatland Drive
Pembroke, VA 24136-3645

The objective of this program is to develop and demonstrate high temperature hydrocarbon-based membranes that possess the chemical, thermal, and mechanical properties necessary to qualify for the demanding environments within a fuel cell vehicle. The approach involves the synthesis of novel, high molecular weight, aromatic hydrocarbon membranes with polar moieties along the polymer backbone and pendant quaternary ammonium groups.

XI.5 Novel Nanocomposite Polymer Electrolyte Membranes for Fuel Cells

NEI Corporation
400 Apgar Drive, Suite E
Somerset, NJ 08873

This project will develop a novel non-perfluorosulfonic acid polymer electrolyte membrane (PEM), utilizing highly proton conducting heteropolyacids (HPAs) in an organic matrix in a way that has not been explored before. The novel HPA/polymer membrane has a unique structure that ensures that the active proton conducting species (HPA) are contained in a continuous interconnected channel. The overall objective of the Phase I project is to demonstrate the feasibility of a robust PEM that has high proton conductivity, low H_2 and O_2 cross-over, and is highly durable for extended use in a fuel cell. NEI has partnered with a well-established fuel cell company to test membrane properties in a fuel cell assembly. The combined effort will advance the state of the art of PEM for fuel cells.

XI.6 Low-Cost Proton Conducting Membranes for PEM Fuel Cells

Amsen Technologies LLC
1684 S Research Loop, Suite 518
Tucson, AZ 85710

This project aims to develop a new, low-cost, proton-conducting membrane for intermediate-temperature fuel cells based on a novel composite approach, which encompasses both the development of new, highly proton-conducting ionomers and the integration of an intriguing membrane support. The use of cheap materials will result in a low-cost membrane and meeting the DOE cost targets.

PHASE II PROJECTS

XI.7 Cross-Polarized Near-UV/Vis Detector for In-line Quality Control of PEM Materials

Mainstream Engineering
200 Yellow Place
Rockledge, FL 32955-5327

This project is developing a real-time, in-line optical detector for the simultaneous determination of membrane thickness and detection of defects. This quality control device will help drive down the costs of fuel cells by reducing waste and improving the efficiency of roll-to-roll manufacturing of fuel cell polymer electrolyte membranes and other specialized membranes.

XI.8 Hydrogen Contamination Detection

Sustainable Innovations, LLC
111 Roberts Street, Suite J
East Hartford, CT 06108

This project is developing a low-cost hydrogen contaminant sensor that is critically important in expanding markets for hydrogen used in industrial and fueling applications. Sustainable Innovations has teamed with the University of

Connecticut to develop an innovative multi-channel hydrogen fuel quality monitor to detect multiple impurities at low levels in hydrogen.

XI.9 Regenerative Fuel Cell System

PH Matter, LLC
1275 Kinnear Road
Columbus, OH 43212

This project will demonstrate a low-cost fuel cell technology. The components developed on this project will improve the efficiency and lower the cost of fuel cell systems. The technology will be used for stationary energy storage applications.

XI.10 Economical Production of Hydrogen Through Development of Novel, High Efficiency Electrocatalysts for Alkaline Membrane Electrolysis

Proton Energy Systems
10 Technology Drive
Wallingford, CT 06492

This project aims to reduce the cost required to manufacture water electrolyzers through development and commercialization of an alkaline exchange membrane (AEM)-based system, enabling the use of non-noble metal and lowering the cost of materials of construction. A prototype laboratory hydrogen gas generator product will be developed to serve as an opportunity for introducing these materials to market at a lower risk entry point and gaining field experience on the pathway to eventually applying AEM technology for larger, energy-related applications, including integrating with renewable energy sources to generate hydrogen fuel while producing minimal carbon emissions.

XI.11 Diode Laser Sensor for Contaminants in Hydrogen Fuel

Southwest Sciences, Inc.
1570 Pacheco Street
Santa Fe, NM 87505

A contaminant detector for hydrogen fuel is needed to prevent fouling of hydrogen fuel cell vehicle engines. This project will develop a laser instrument for the detection of hydrogen contaminants at fuel stations.