CHANGING WHAT'S POSSIBLE

OPEN+ Concrete and Methane Cohorts

PROJECT DESCRIPTIONS

Concrete

Neuvokas Corporation – Ahmeek, MI

Energy Efficient, Incrementally Scalable, Continuous Basalt Fiber Filament-forming Extrusion Bushing –$2,000,000

Neuvokas Corporation will develop an energy-efficient continuous basalt fiber (CBF) manufacturing process. The project will focus on the filament-forming extrusion bushing. The final deliverable will be a filament-forming extrusion bushing capable of supporting the production of low-cost, high-quality CBF at scale. Using CBF instead of steel to reinforce concrete can reduce capital expenses, greenhouse gases, and operating expenses, and increase concrete service life and time to major maintenance by more than 30 years, saving greater than 0.5 quad (146,535,500,000 kWh) of energy per year.

Rutgers University – New Brunswick, NJ

Microbial Curing of Cement for Energy Applications –$2,932,154

Rutgers University, Lawrence Livermore National Laboratory, and the University of Arizona, will develop a new manufacturing process for carbonate cement concrete (C3), an alternative to traditional ordinary Portland cement (OPC) concrete. C3 utilizes carbon dioxide instead of water to solidify the material. C3 now relies on externally-introduced carbon dioxide for solidification. This program will use microbes within the microstructure to produce carbon dioxide internally for solidification. Microbial-cured C3 is expected to last longer than OPCC, which will reduce the need for concrete repair and replacement. This in turn reduces energy consumption, carbon dioxide emissions and costs associated with concrete-based projects. Techno-economic and lifecycle analyses will quantify these benefits.

University of Virginia – Charlottesville, VA

Carbonation-Enabled Mineralization to Engender Novel Technology – $1,186,934

The University of Virginia, in collaboration with C-Crete Technologies, is developing a new approach to making cement using the calcium silicate mineral pseudowollastonite. When pseudowollastonite is exposed to moderate heat and alkaline conditions with carbon dioxide and water, it reacts to form mineral phases that are much stronger and more stable than commercial cements. This project's objectives are to identify inexpensive mineral feedstocks and industrial waste materials (e.g., flue gas from coal-fired power production, fly ash, and slag from municipal solid waste incineration) to produce pseudowollastonite-based cements at scale, and optimize its reaction and curing conditions to result in strong, durable pre-cast structures. These materials would require only a small fraction of the energy used to produce conventional cements.

Methane

Rice University – Houston, TX

Converting Hydrocarbons to Recyclable Materials for Metal Replacement with Positive Hydrogen Output – $3,300,000

Rice University will develop recyclable, lightweight materials that could be used to replace metals in automotive applications. The team will convert natural gas into carbon nanotubes with concurrent production of hydrogen, spin them into fibers, and evaluate the fiber performance and properties with the target of displacing metals. The proposed technology could significantly reduce energy consumption and carbon dioxide (CO2) emissions associated with metal production, while producing hydrogen. Such recyclable, lightweight, and low-cost materials could provide an alternative to metals in automotive applications, reducing vehicle weight, reducing fuel and energy consumption, and reducing CO2 emissions.

Nanocomp Technologies, Inc. – Merrimack, NH

High Value, Energy Saving Carbon Products and Clean Hydrogen Gas from Methane – $3,479,624

Nanocomp Technologies will develop an industrially scalable method to convert natural gas to a high-value carbon material, Miralon®, while also producing hydrogen. Converting methane to solids serves effectively as pre-combustion carbon capture. This project aims to build a flexible, transportable network of production systems that can be installed at methane generation or consumption sites and redeployed to new locations. The application of the technology could result in U.S. energy savings and CO2 emission reductions.

ETCH, Inc. – Chevy Chase, MD

Carbon Dioxide-Free Hydrogen and Solid Carbon from Natural Gas via Metal Salt Intermediates – $3,690,304

ETCH will scale-up a novel process to convert natural gas into hydrogen and solid carbon with no water input and reduced carbon dioxide (CO2) emissions. Leveraging industrial partners, Southern Company and Cabot Corporation, the team will scale-up the ETCH cyclic process based on early laboratory demonstrations. The process is expected to produce hydrogen fuel from natural gas at costs comparable to the state-of-the art commercial technologies, while lowering energy input, reducing CO2 emissions, and producing high-value pure carbon materials.

Palo Alto Research Center, Inc. – Palo Alto, California

High-Throughput Methane Pyrolysis for Low-Cost Hydrogen – $3,946,542

Palo Alto Research Center (PARC) and its partners will develop a new, high-throughput reactor technology for hydrogen (H2) production. The team will demonstrate the use of a molten-metal mist reactor to convert natural gas into hydrogen and solid carbon at a low cost without carbon dioxide emissions. The technology could replace current H2 production methods, while simultaneously sequestering carbon in high value materials and placing the United States at the forefront of the H2 production industry.