Department of Energy Authorizes Ramaco Carbon-Affiliated Carbon Fiber Research Project to Proceed

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Laramie, Wyoming — A research project led by Western Research Institute (WRI), aimed at dramatically lowering the cost of carbon fiber and improving the efficiency of vehicles, was approved by the U.S. Department of Energy (DOE) to proceed into the second year of a three-year program.

As part of the consortium of organizations working on the project, WRI is working closely with Ramaco Carbon, a private company based in Sheridan, WY, for converting coal pitch compounds that are then spun into carbon fibers by team members at Oak Ridge National Laboratory (ORNL) in Tennessee.

The carbon fiber research project — titled, "Consortium for the Production of Affordable Carbon Fibers in the United States" — supports the program goals of the DOE Vehicle Technology Office (VTO), within the Office of Energy Efficiency and Renewable Energy (EERE), to reduce the weight of cars by lowering the cost of carbon fibers to $5 per pound or less, which will result in improved fuel economy and reduced emissions.

"This project helps Ramaco achieve our goal of becoming a leading player in the emerging use of coal to make carbon fiber precursors to be used in vehicles, or what we affectionately call "Coal-to-Cars," said Randall Atkins, chairman and CEO of Ramaco. "This innovative approach will enable the U.S. to find uses for its abundant coal resources beyond burning coal for electricity. Ramaco is excited to be at the forefront of developing new sustainable uses for coal that can help keep coal miners employed.

The project's results for the first phase met all success criteria and milestones. The project's main goal is to develop carbon fiber materials using

natural carbon sources as feedstocks, including abundant domestic coal reserves.

“Our team exceeded the first-year goals, and we are very excited for the progress to continue in the second year of our project,” said WRI Chief Executive Officer Don Collins. “We greatly appreciate the confidence this decision shows in our team.”

“We are fortunate to have a strong multi-disciplinary team covering the basic sciences through manufacturing processes, as well as the business aspects for successful commercialization,” said Collins. “This is essential to making transformational advancements in the automotive industry, which will improve sustainability throughout the supply chain of raw materials and ultimately lead to more efficient cars.”

The WRI-led consortium also includes members of the University of Wyoming’s Mechanical Engineering Department, researchers from MIT and Oak Ridge National Laboratories, and several private firms. The project was selected for negotiations under a competitive funding opportunity with the final negotiated project valued at $5.2 million. Work on the project began in 2017. Industry partners also include industry advisor Solvay in South Carolina.

Collins explained that the team has already achieved and outdone the strength goals for carbon fiber established for the project. This enables the team to improve the strength further during the second year while improving both quality and cost.

The initial cost analyses predict the cost to produce carbon fiber will be lower than the $5 per pound target identified by the automotive industry, Collins added. Compared to the current cost of $12-$15 per pound, this would enable widespread use of carbon fibers, which are stronger and lighter than many other materials currently used in vehicles.

An overarching priority of the project is to develop predictive software models that more accurately predict how changes in both the starting

material composition and the production processes relate to carbon fiber strength.

As part of the consortium of organizations working on the project, WRI is partnered with a team led by the Grossman Group at MIT, which applies advanced multiscale computer modeling (from atoms to carbon fibers) and machine learning predictive methods to identify how the various starting material compositions relate to the compounds produced in the multiple production stages, and finally in carbon fiber strength. The accuracy and precision of these predictive programs will be improved in the project's second year, using additional data developed throughout the consortium team.

Additionally, a team from the University of Wyoming's Department of Mechanical Engineering, led by Dr. Fertig and Dr. Frick, is fabricating tow-level composites from the fibers and developing advanced finite element modeling tools to improve the design of carbon fiber composite parts for cars.

The consortium is studying the use of biomass, coal, gilsonite and petroleum as starting resources from which to make carbon fibers. Another member of the project's consortium — Southern Research, based in Alabama — is leading the work to make acrylonitrile from biomass-derived sugars. Advanced Carbon Products, based in Kentucky, is heading up the work on turning petroleum-derived pitch to carbon fiber.

In addition to its work with Ramaco Carbon, ORNL also conducts fiber strength tests and provides data to MIT and other team members to improve carbon fiber production. WRI is in charge of the chemical characterization of the raw materials and precursors using leading-edge analytical tools, some of which were invented by WRI. That data is key to the development of the predictive models at MIT.

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Ramaco Carbon contact:
Liz Brimmer
307-690-1910
liz@brimmercom.com

WRI contact:
Cortni Lentz
307-721-2208
clentz@uwyo.edu