Utah Coal
to Advanced Products
State of Utah FY21

Overview

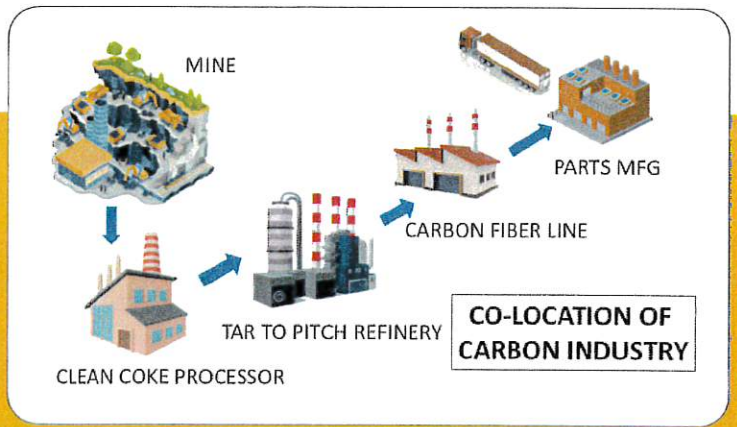
In 2016 the U.S. Economic Development Administration ("EDA") awarded the University of Utah a POWER grant to research cost-effective methods of turning coal-derived pitch into carbon fiber. Additionally, under this $1.6 million effort, the University of Utah is analyzing the market potential of coal-derived carbon fiber to help revitalize coal communities threatened by a decline in coal production.

Recognizing the high potential an integrated program (focusing on manufacturing coal pitch carbon fiber and other advanced products) could have on coal-based economies, the University of Utah organized and is now leading a multi-state consortium. This effort placed the State of Utah at the forefront of a high-value emerging industry.

The program is focused on producing high-quality pitch material from Utah coal and processing the coal-derived pitch into carbon fibers of suitable quality for particular applications. The program is also focusing on fiber prototyping, characterization, and computer-aided optimization of the coal to carbon fiber pipeline.

In fiscal year 2019, the State of Utah appropriated $500,000 to further develop the coal to products program and position it as a U.S. Department of Energy program. The State of Utah appropriation resulted in great progress.

Due to the University of Utah's efforts—leveraging the State of Utah appropriation—Congress placed $13,000,000 in Department of Energy's FY19 budget for research into coal-derived carbon fiber and other coal-derived products. The University of Utah is optimistic that it will be successful in contracting some of this funding for continued research and the establishment of a coal to products industry in the State of Utah.



Part 1. Experimental Research and Development

The proposed experimental activities for FY21 will focus on two parallel tracks: 1) continuation of the development of coal to carbon fiber technology, and 2) initiating development of technology for producing other solid carbon products from coal, such as carbon electrodes for large-scale lithium-ion batteries (for electric vehicles, utility-scale electricity storage, etc.), and also graphite and graphene. All of these are very high-value products with significant market potential. Our purpose for initiating the second, parallel path is to identify additional marketable coal products to improve the economic viability and competitiveness of carbon fiber production from coal.

State Fiscal Year 2021

Task 1 – Scaling up the production of coal-derived pitch
This work will be carried out at the University of Utah's Industrial Combustion and Gasification Research Facility. A Utah-based company, Amaron Energy, will provide (under subcontract) the use of their prototype biomass pyrolysis facility, which will be modified by the University of Utah to facilitate the pyrolysis of coal to produce and collect coal tar liquids.

Task 2 – Upgrading coal tar to mesophase pitch
The prototype pyrolysis facility described in Task 1 will include additional modifications to allow upgrading of the coal tar to produce mesophase pitch.

Task 3 – Carbon fiber production and characterization
The mesophase pitch produced in Task 2 will be shipped to the University of Kentucky who will optimize carbon fiber production from the pitch. The resulting carbon fiber will be tested for physical properties and compared against commercial carbon fiber.

Task 4 – R&D on production of alternate solid carbon products (carbon electrodes for large-scale batteries, graphite, graphene)
Laboratory-scale research will be carried out on methods for producing other solid carbon products from coal. The carbon products to be evaluated include carbon electrodes, graphite and graphene. The viability (both technical and economic) of producing each of these products from coal will be assessed during FY21.

Benefits - Coal Related Jobs

- Long-term Rural Economic Impact
- New non-combustion use for coal and continued mining
- Retains jobs including indirect
- Construction of new coal processing and manufacturing facilities
- New job opportunities in processing coal, manufacturing of fiber and finished part manufacturing
- Processing and marketing of by-products
- Strong support from local communities and GRP

Part 2. Computational Research and Development

To position the state of Utah in a strategic position with respect to current efforts of converting and sustaining the coal industry into high technology products we propose to continue and expand efforts to create a central hub that allows attracting new technology and key partners.

The current effort includes the efficient development and scaling of carbon fiber and other technology via the conversions of novel laboratory processes to industrial scale using a combination of field testing supported by Big Data analytics and simulation technology.

We propose the development of the state level portal documenting the characteristic of Utah coal development of the new processes for its transformation of high value products. This will support scientists in new research activities and industry in improving future production capacity. Two aspects will be explored in combination: (i) the technical information regarding the materials and the engineering processes needed to implement the new capabilities and (ii) correlation to the economic growth of the state and integration with the planning of industrial positions and workforce development.

We will also develop computational models and capabilities for simulation of new coal production capabilities and assessment of their efficiency and therefore economic viability.

Task 1 – Create new capabilities of the prototype database for coal and coal-derived pitch characterization information and introduce the ability for remote access, distributed analysis and visualization using web based technology.
Task 2 – Establish a community portal documenting the activities of the project and providing general access and dissemination to partner institutions in support of current and future collaborations.
Task 3 – Development of new data exploration capabilities focused on the support of the alternate solid carbon products such as carbon electrodes for large-scale batteries, graphite, and graphene. These new capabilities will impact both the back end database, the data query system and the data visualization and exploration environment.
Task 4 – Development of new simulation capabilities that assess the viability and efficiency of the chemical processes involved in the carbon fiber production and its output quality.

Proposed budget for State FY21 $500,000

Program Contacts

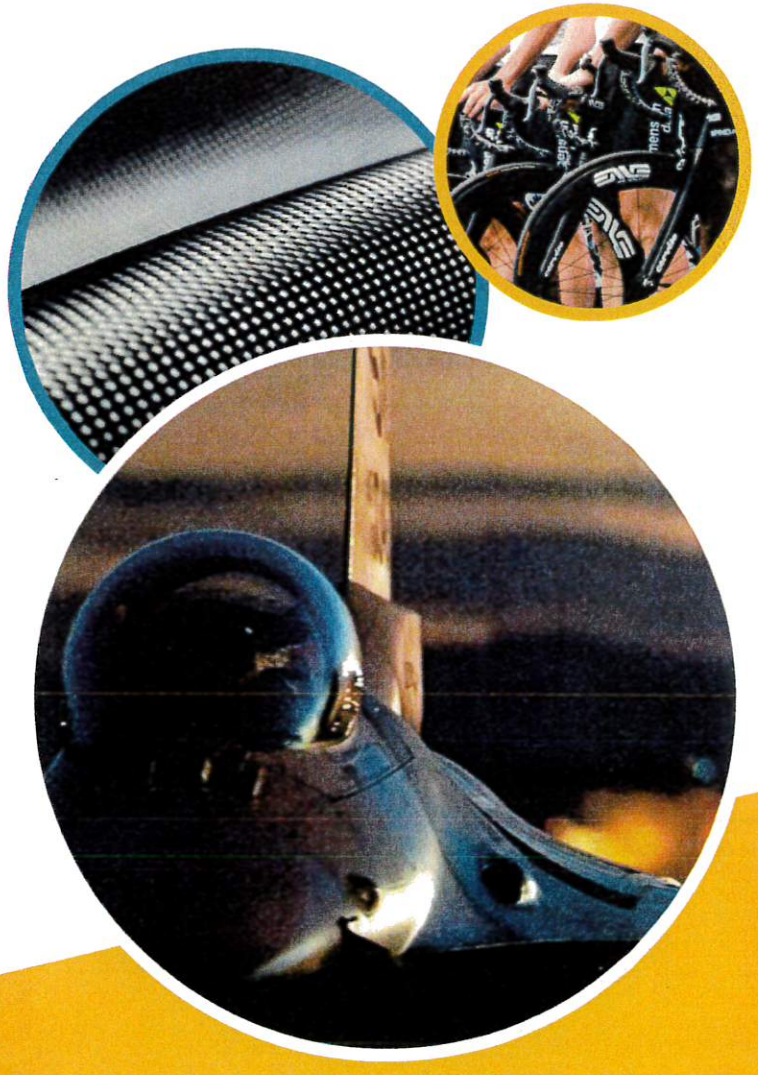
Jeremiah Riley, JD
jeremiah@uintagroup.com
435-770-2467

University of Utah research contact:

Chris Johnson, PhD
crj@sci.utah.edu
801-587-7875

U.S. DEPARTMENT OF ENERGY

OAK RIDGE National Laboratory

Multi State Coal Consortium Project

- 5 state project – UT, AK, KY, WV, WY
- UT (PI) Coal to pitch conversion and process simulation
- KY Fiber spinning and carbonization
- AK Fiber characterization
- ORNL Fiber manufacturing scale up
- WV Coal mine logistics
- Seeking $5-10M/yr from FY19 DOE for 10 years
- State funds would help us win federal $