ALBERTA INNOVATES

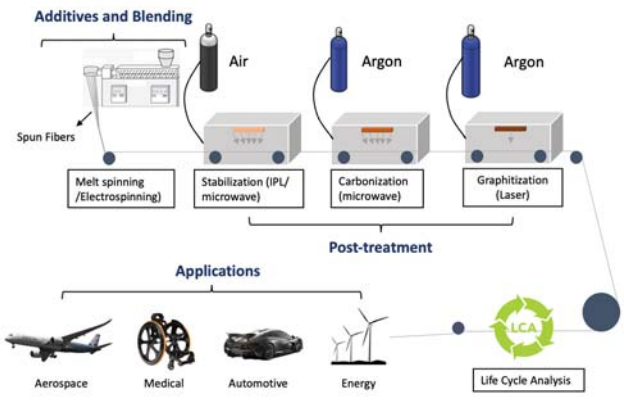
CLEAN RESOURCES

ADVANCED HYDROCARBONS

INNOVATIVE HYDROCARBON PRODUCTS – BITUMEN BEYOND COMBUSTION

Energy Efficient Carbon Fibre Productions using Alberta Oilsands Asphaltene

Alberta Oilsands Asphaltene (AOA) is typically generated as by-products from upgrading processes. Carbon fibre is a strong, lightweight, electrically and thermally conductive material consisting of carbon atoms. AOA has a high possibility of gaining an edge in competitiveness for carbon fibre precursors. Since the heat treatment process such as stabilization and carbonization accounts for most of the energy consumption, developing the energy efficient heat treatment process is a direction that can solve environmental challenges. By producing asphaltene-based carbon fibres that are significantly cheaper and greener than the alternatives available, Alberta can compete on the world stage of carbon fibre production.



FUNDING DETAILS

RECIPIENT:
University of Calgary (Dr. Simon Park)

PARTNERS:
University of Alberta, Queen's University, CRIN

TOTAL BUDGET:
$1,194,732

AI FUNDING:
$45,000

PROJECT DATES:
AUG 2021 – JAN 2023

PROJECT TRL:
Start: 3
End: 7

APPLICATION

The generated carbon fibre has a material grade of the fibre according to the manufacturing process. Uses of low-intensity carbon fibre may include water filtration, electrodes, and sensors. Also, carbon fibres are usually combined with other materials to make the carbon fibre reinforced composites. The high-strength carbon fibre can be used in vast range of industries such as mechanical fillings, sports, automobiles, military and ships. Ultra-high strength carbon fibre, which has been graphite, is applicable to aerospace.

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PROJECT GOALS

The objective is to produce cost-effective carbon fibre fabrications by utilizing asphaltene precursors from AOA. In this project, both melt spinning and electrospinning methods are utilized to produce fibre from different asphaltene-based precursors. Presently, the high temperature and long stabilization and carbonization times result in significant energy consumption and GHG emissions. Polymer blended asphaltene was fabricated through the melt spinning and electrospinning methods. Each process is optimized to achieve continuous uniform fibre. The University of Calgary team has recently developed a new method for drastically reducing the stabilization and carbonization time for carbon fibre generation through the utilization of chemical oxidation and electromagnetic irradiations. This would significantly reduce costs, time and Greenhouse Gas (GHG) generations to convert the abundant AOA into carbon fibre.

BENEFITS TO ALBERTA

Alberta Oilsands Asphaltene (AOA) derived carbon fibre is a strong and lightweight material. This project will help diversify Alberta's income as it will provide another opportunity for using a resource that is already being extracted. The carbon fibre market is currently valued at about 5 billion USD and is expected to grow to over 13 billion USD in the next decade. The most significant benefits from this project are rooted in the ability to process AOA derived CFs with low energy and minimum GHG generations. The production of environmentally friendly and sustainable carbon fibre allows Alberta to tap into new opportunities. From there, new jobs will be created in the fields of manufacturing, research, sales, exports and investments.

5 Publications

8 Students Trained

1-2 Patents

1-10 Future Jobs

CURRENT STATUS

AUG 2022

Carbon fibres have been prepared by using Alberta Oilsands Asphaltene. Polymer additives were used, and the results indicate they can improve the processibility of asphaltene. Meanwhile, electromagnetic post-treatment processes have been performed to assist or replace the conventional post-treatment processes. The preliminary LCA and TEA results show new post-treatment processes can significantly reduce the GHG emissions and cost of carbon fibre.