ALBERTA INNOVATES

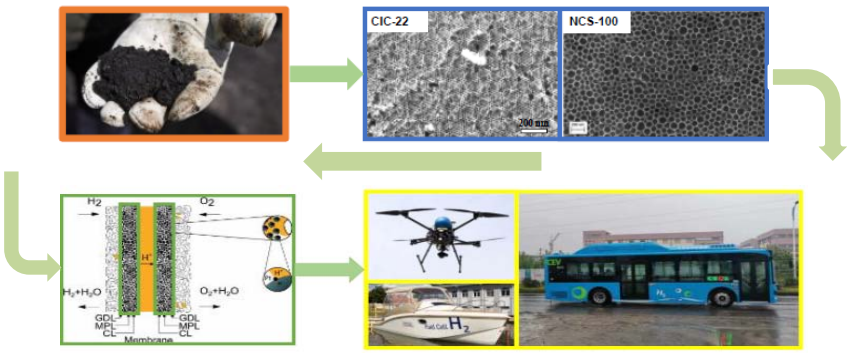
CLEAN RESOURCES

ADVANCED HYDROCARBONS

INNOVATIVE HYDROCARBON PRODUCTS – BITUMEN BEYOND COMBUSTION

Development of Next Generation Membrane Electrode Assembly Using Alberta Asphaltene-Derived Novel Nanoporous Carbon Materials for High Performance PEM Fuel Cell

Asphaltene is an abundant by-product of Alberta's oil and gas industry and a highly aromatic material, which has significant promise in terms of its utilization in manufacturing advanced carbon materials. An Alberta start-up, Momentum Materials Solutions, aims to convert the low-value Alberta asphaltenes into high-value, novel, nanoporous carbon materials, including nanoporous carbon scaffold (NCS) and colloid imprinted carbon (CIC), for developing order-structured membrane electrode assemblies (MEA). The asphaltene derived MEA for use in high performance hydrogen fuel cells would create a new supply chain for fuel cell MEA production in Canada and also benefit and diversify Alberta's economy.



FUNDING DETAILS

RECIPIENT:
Momentum Materials

PARTNERS:
University of Calgary, GRInSTEM, Giner Inc.

TOTAL BUDGET:
$486,500

AI FUNDING:
$243,250

PROJECT DATES:
MAR 2022 – MAR 2024

PROJECT TRL:
Start: 2
End: 6

APPLICATION

Membrane electrode assembly (MEA) is the heart of a polymer electrolyte membrane fuel cell (PEMFC) and the target market for this technology includes PEMFC, hydrogen vehicles, hydrogen drones and so forth. The advanced nanoporous carbons could also be applied in markets such as batteries, hydrogen electrolysis and sensors. This project will also generate knowledge on transferring Alberta asphaltene into value-added precursor materials that can be the feedstock for many other advanced carbon products.

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PROJECT GOALS

The key goals of the project are:

- Developing a method to convert Alberta's asphaltenes into high-quality pitch feedstock suitable for the preparation of the novel nanoporous carbon scaffold (NCS) or colloid imprinted carbon (CIC).
- Validating the properties of the asphaltene derived NCS or CIC, achieving desired specific surface area, conductivity and porosity.
- Developing the order-structured membrane electrode assembly (MEA) using the asphaltene derived NCS and/or CICs.
- Validating the performance of the order-structured MEA, achieving 10% improvement in fuel cell performance and two times longer durability as per the DOE's MEA target.

BENEFITS TO ALBERTA

The successful implementation of this technology or use of the knowledge generated could result in:

- Reductions in 10.8M metric tons of CO_2 in Canada by 2030.
- Improvements of Alberta's economy by generating annual revenues of $3M in the short term, as well as creating more than 10 new positions in cleantech manufacturing.
- Partnerships between the University of Calgary, Momentum Materials Solutions and potential customers and distributors (e.g. Giner Inc.) will facilitate the commercialization of university innovation and cultivate young talent.
- Commercial uses of the carbon and MEA technologies will create added value to Alberta's oil and gas industry, diversifying Alberta's economy and contributing to Canada's net-emission goal.
- Policy development in MEAs would accelerate the improvement of the fuel cell industry's standards.

1 Publication

2 Students Trained

1-10 Project Jobs

11-100 Future Jobs

1 New Product/Service

1 Patent

10-100 kt/yr Future GHGs Reduced

CURRENT STATUS

AUG 2022

Momentum Materials Solutions has been conducting a literature review and generating plans for first transferring the asphaltene to mesophase. Characterization of the asphaltene samples has been collected and will be analyzed in detail.