Development of Novel Niobium Based Porous Transport Layer for Proton Exchange Membrane Water Electrolysis

Canada has targeted a 30% reduction of 2005-level GHG emissions by 2030 and aims to realize net-zero emissions for 2050, requiring major investment in decarbonization strategies. Hydrogen technologies have been recognized as an important contributor to clean, efficient, and reliable energy alternatives. Hydrogen is one of the most efficient energy carriers and can be produced by different methods. Among all the production methods, the proton exchange membrane water electrolyzer (PEMWE) is considered the most promising technique to produce highly pure hydrogen from renewable energy sources with pure oxygen as by-products with no carbon emissions. The PEMWE technology has reached the early stages of commercial deployment while the mass production is tied to cost reduction. The single electrochemical cell includes a membrane electrode assembly (MEA), porous transport layers (PTLs), and bipolar plates (BPPs). The PTLs cover the MEA on both sides and play an important role in cell performance, and durability as they are responsible for electrical and heat conduction in the cell as well as mass transport and accessibility of the reactants. In addition, they provide mechanical support to the delicate catalyst layers in MEA. Therefore, they need to meet certain requirements to perform inside the stack, for example, good electrical and heat conductivity, high corrosion resistance, minimum contact resistance and low mass transport losses. Niobay and UQTR are going to develop novel and cost effective Nb based PTL for PEM water electrolysis to meet all the criterias.

Canada has emerged as a global leader and a home to a significant concentration of global hydrogen expertise and supply chain network. Canadian companies are well positioned to supply international commercial demand for hydrogen-powered vehicles, energy storage devices, and hydrogen production facilities. Global supply chains for numerous industries, including hydrogen, have been negatively impacted by the pandemic. Development of key subcomponents for eventual hydrogen production within Canada will enhance the local supply chain network. Many sectors have met challenges related to jobs and economic growth as a result of the pandemic. Highly qualified personnel (HQPs) and strong collaboration with universities and industry partners will be created through this project. The proposed research proposal provides solutions for the cost challenge and has significant impacts on the economy. This project will support new material development, supporting growth of the hydrogen industry through product cost reduction and manufacturing scale up opportunities.