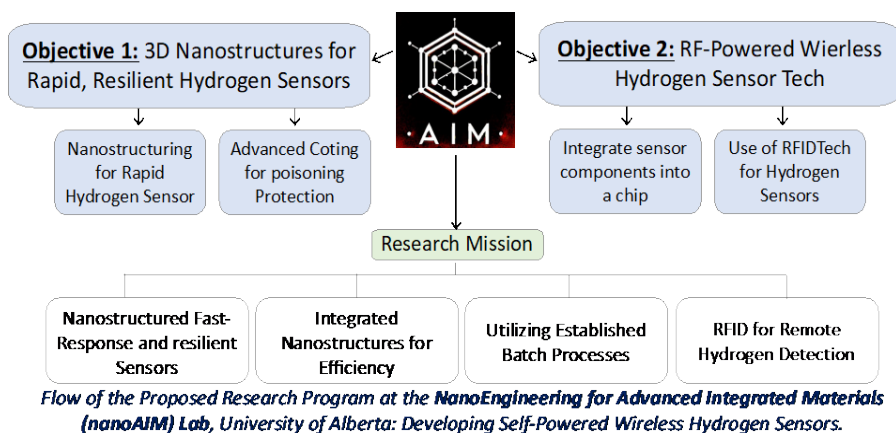


Empowering Hydrogen Safety: Innovative Nanoarchitected Sensors for Sustainable Energy

The global shift toward sustainable energy highlights hydrogen as a key solution, with Alberta's Hydrogen Roadmap leading the way toward prosperity, clean energy, and job creation. Yet, this growing focus on hydrogen also underscores a critical issue: ensuring hydrogen safety. Recent events, like the hydrogen station explosion in Norway, emphasize the urgent need for reliable, rapid-response safety sensors. Existing hydrogen sensors struggle to meet stringent performance standards set by agencies like the US Department of Energy (DoE). This project aims to develop innovative, Alberta-made hydrogen safety sensors that address these challenges and align perfectly with the province's Hydrogen Roadmap. Our sensors will support safe hydrogen use across various sectors, including residential and commercial utilities, transportation, power generation, energy storage, industrial processes, and new export markets. Leveraging our expertise in radio frequency energy harvesting, we will create self-powered, wireless hydrogen sensors that do not require internal batteries. By integrating advanced nanoarchitected sensing microstructures with RF readout circuits into a single cost-effective and maintenance-free system, our technology will deliver quick and accurate detection, greatly enhancing hydrogen safety.



RECIPIENT:

UofA – Dr. Mahdi Hamidi



TOTAL BUDGET:

\$1,123,000



PROJECT DATES:

**JUN 2024 –
MAR 2026**



PARTNERS:

**Phase Sensors,
University of
Cambridge**



AI FUNDING:

\$433,000



PROJECT TRL:

**Start: 3
End: 6**

APPLICATION

The innovative hydrogen sensors developed in this project are broadly applicable across multiple sectors. Key applications include monitoring hydrogen safety in transportation (e.g., fuel-cell vehicles and hydrogen fueling stations), energy generation and storage facilities, residential and commercial utilities, industrial processes involving hydrogen, and personal safety through wearable sensor technologies. The self-powered, wireless capabilities make them ideal for remote locations, large industrial complexes, and environments where traditional wiring is impractical, significantly enhancing safety and operational efficiency in these critical applications.

PROJECT GOALS

This project aims to advance hydrogen safety technologies critical to Alberta's expanding hydrogen economy. Specifically, our goal is to develop state-of-the-art, self-powered wireless hydrogen sensors designed for high reliability and rapid response. Key objectives include:

- **Rapid Detection:** Achieve response times under 5 seconds to swiftly identify hydrogen leaks.
- **Robust Reliability:** Ensure sensors maintain performance under challenging conditions, including high humidity and exposure to poisoning gases.
- **Cost-Efficient Integration:** Develop compact, cost-effective sensors using advanced nanomanufacturing techniques.
- **Wearable Safety Solutions:** Create versatile sensor applications, including wearable technologies, to broaden market adoption and enhance personal and industrial safety.

BENEFITS TO ALBERTA

This initiative provides economic, environmental, and technological benefits to Alberta, positioning the province as a global leader in hydrogen safety innovation. It contributes to economic diversification and environmental sustainability. Specific benefits include:

- **Economic Growth:** Expansion of Alberta's advanced sensor manufacturing sector, leading to high-value job creation.
- **Safety Enhancement:** Improved safety standards in hydrogen infrastructure, boosting public confidence and enabling widespread adoption.
- **GHG Reduction:** Accelerated transition to safe hydrogen technologies, substantially reducing greenhouse gas emissions.
- **Global Leadership:** Establish Alberta as a worldwide hub for hydrogen safety innovation, attracting investment and fostering international partnerships.

**3 Publications****5 Students
Trained****1 Patent****3 Project Jobs****5 Future Jobs****1 New
Product/Service****1 Spinoff
Company****1-2 kt/yr Future
GHGs Reduced**

JUN 2025

The project has commenced and is currently focused on laboratory testing and the scalable fabrication of sensors.