The NIMPHEA consortium will develop a key enabling technology for the deployment of fuel cells in aviation

This new EU-funded project will focus on the development of a new generation Membrane Electrode Assembly – the central component of Proton Exchange Membrane Fuel Cells – compatible with aviation applications.

Air traffic is constantly increasing, and aviation is responsible for a significant proportion of greenhouse gas emissions. The European Union has set the objective of achieving carbon neutrality by 2050, and the Advisory Council for Aeronautic Research in Europe (ACARE) is targeting a 75% reduction in aviation emission in the next 30 years.

Hydrogen-based fuel cell systems are one of the most promising solutions to deliver energy to aircrafts without emitting CO_2 and NO_x. Fuel cells enable the conversion from chemical energy contained in a fuel such as hydrogen into electricity. Proton Exchange Membrane Fuel Cells (PEMFC) have been widely developed for on ground transport applications over the last 20 years. The Membrane Electrode Assembly (MEA) is the core component of this technology.

Today, fuel cell systems developed in the automotive industry are operated at a typical temperature below 100°C. This operating temperature generates constraints that make their integration in the aircraft environment extremely difficult due to thermal management issues. The development of a new-generation MEA, working at temperatures above 120°C , is one of keys to unlock fuel cell applications for aviation industry. In this context, the NIMPHEA project will develop and validate a new-generation, high-temperature MEA that meets the requirements of fuel cells for aviation.

Demonstration of the developed technology under laboratory test conditions will prove the feasibility of the concept and pave the way towards further maturation within the Clean Aviation programme for integration into a specific architecture for demonstrations.

Within the project Fraunhofer ICT will coordinate the single cell test activities reaching from measurements at 1 cm² cell under differential conditions to determine limiting electrode activities up to measurements at MW stack scale single cells. In its own labs Fraunhofer ICT will address the development and performance of single cell test at laboratory technical sale which allow to determine airworthiness of fuel cells at MEA level. For that operation profiles of the two target applications electric propulsion and APU will be analysed and critical single cell conditions determined. Specific tests to determine the fitness of the MEA will that be I implemented and performed.

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