Contribution ID: **47** Type: **Oral**

Cryogenics for Aviation: Opportunities and Challenges

Thursday 30 October 2025 09:10 (20 minutes)

Aviation is an important pillar of mobility and is essential for a globalized world. The aviation industry has recovered from the Corona crisis and, as expected, is poised to grow in the coming decades at a rate of around 4% per annum. With this compounding growth, the climate impact of aviation is expected to increase substantially. While ground transportation can electrify, at least to a large extent, this option is not realistic for aviation due to the low energy density of batteries. In this scenario, hydrogen, particularly cryogenic liquid hydrogen (LH2), offers a promising alternative to decarbonize the aviation sector, especially for the short to medium range aircraft. The paper outlines the opportunities that LH2 offers to decarbonize the aviation industry, especially in terms of climate impact, and the challenges in terms of fuel supply, fuel storage and refueling systems.
The paper describes the LH2 refueling systems for aircraft, as well as the onboard fuel supply systems required for two different propulsion concepts, namely a hydrogen-electric powertrain for a turboprop and a gas-turbine-powered SMR aircraft. The overall propulsion system for both aircraft types is discussed in detail with their impact on the LH2 fuel system design.

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Track Classification: Liquid Hydrogen in Aviation