Polymer Matrix Composites for Light-weighting of Cryogenic Electric Propulsion System

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***Abstract* — Development of electric, hybrid and turboelectric propulsion technologies for electrified aircraft propulsion system is seen as essential for reduced fuel consumption, emissions and noise pollution. Renewable energy-based liquid hydrogen (LH_2) is a potential solution to meet the stricter environmental requirements under consideration by various governments. This paper will provide an overview of a cryogenically cooled turbo-electric power train. To achieve weight metrics, light-weighting of generators, cables, circuit breakers, interconnects and the thermal management system is critical. Additionally, materials with high and low thermal conductivity are required in cryogenic environments. While fiber reinforced composites materials are promising due to their lighter weight and high strength, effect of cryogenic temperatures (around 20K) on their properties is not well understood. This paper will survey some challenges in the application of fiber-reinforced composite materials at cryogenic temperature for structural strength, including behaviors such as micro-cracking and thermal distortion.**

***Keywords (Index Terms)* — Fiber-reinforced Composites, composites, polymer matrix composites, electrification, aviation, electric propulsion, carbon-fiber composites, cryogenics, cryogenic motor, liquid hydrogen.**

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