Chair of Carbon Composites
TUM School of Engineering and Design
Technische Universität München

Master`s Thesis, Term Project, Bachelor`s Thesis

Experimental Characterization of Composites for Hydrogen Pressure Vessels.

With the new objectives for greenhouse gas reduction set by the European Union, the use of green hydrogen fuel to power vehicles or aircraft (as presented by Airbus with the ZEROe) is getting more and more interest in the industry. One of the main challenges towards the broader application of hydrogen is the improvement of onboard storage solutions. The Chair of Carbon Composites (TUM-LCC) performs research activities on the design and manufacturing of Composite Overwrapped Pressure Vessels (COPV) for hydrogen applications (automotive, truck, or aerospace). We aim to use carbon composites' full lightweight potential to reduce pressure vessels' weight, increase storage capacity, and thus enable green hydrogen mobility. To achieve this goal, it is crucial to understand and describe the anisotropic material behavior and its dependence on relevant conditions (temperature, time effects).

Within the scope of this thesis, the mechanical behavior of a carbon fiber composite material under low temperatures and dynamic loading will be investigated. This will involve the development and comparison of manufacturing methods to produce suitable specimens of high quality. Since the characterization under the conditions above is not standardized, an important task is the verification of existing approaches and further improvement. Since the temperature and time dependence of a polymer’s mechanical behavior interact, the superordinate goal is to identify and describe their relationship based on the experimental results.

Figure 1: Zero-emission concept aircraft [Airbus]

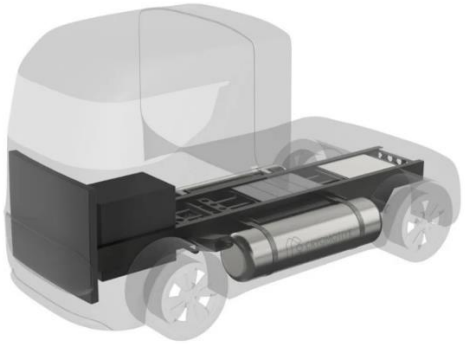

Figure 2: Hydrogen-powered truck concept [Cryomotive]

Research focus

- Literature review for the relationship between temperature- and short-time-(strain-rate)-effects
- Development of the manufacturing process for neat resin specimens (comparison of different approaches)
- Manufacturing and characterization of neat resin and composite specimens by experimental testing
- Identification and description of the time-temperature-relationship based on the experimental results

Requirements

- Reliable and independent way of working
- Experience with experimental characterization methods is beneficial

Starting date: Flexible

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