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

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

Influences of Manufacturing and Design on the Recycling of Composite 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 gaining increasing interest. One of the main challenges to the broader application of hydrogen is improving onboard storage solutions. The Chair of Carbon Composites (TUM-LCC) performs research activities on the design and manufacturing of Composite Overwrapped Pressure Vessels (COPVs) for hydrogen applications (automotive, truck, or aerospace). One important factor is the sustainability of the COPVs themselves. Recycling by recovering and reusing fibers from old COPVs presents a promising solution towards that goal.

Within the scope of this thesis, the recycling of Type IV COPVs will be investigated. Building on previous work at TUM-LCC, the carbon fiber overwrap should be designed using “design for recycling” principles. The developed COPVs will be manufactured by filament winding for subsequent pyrolysis or solvolysis, which will be carried out by project partners. After the fibers are separated from the matrix, they can be reimpregnated with the matrix to create a recycled composite material. The quality and properties of the recovered material should be characterized and compared with those of the virgin material using mechanical tests. Finally, demonstrator COPVs will be manufactured from recycled material to demonstrate the potential for industrial applications.

Figure 1: Zero-emission concept aircraft [Airbus]

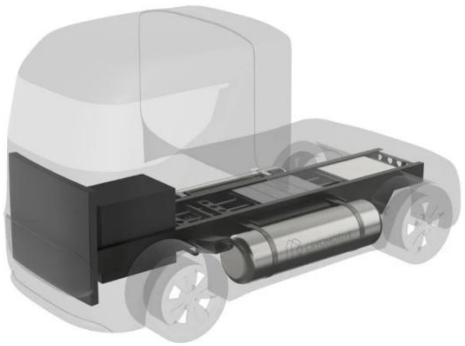

Figure 2: Hydrogen-powered truck concept [Cryomotive]

Research focus

- COPV design with a focus on subsequent recycling
- Manufacturing of Type IV COPVs
- Investigation on the reimpregnation of recycled fibers
- Mechanical characterization of specimens made from recycled carbon fibers

Requirements

- Reliable and independent way of working
- Experience with composite manufacturing is beneficial
- Experience with analysis of composites (analytical or numerical) is beneficial

Starting date: Flexible

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