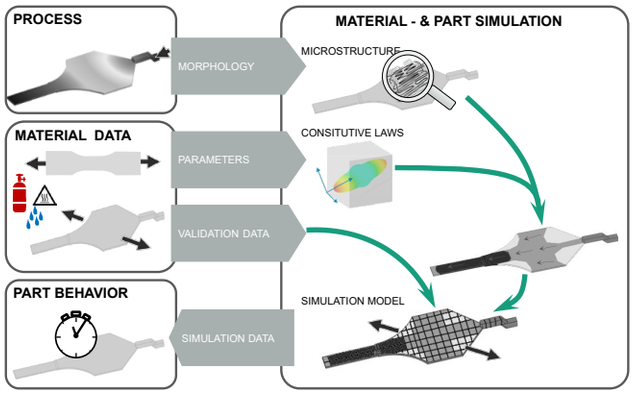

Integrative simulation toolbox for complex mechanical and environmental interactions.

Project examples

- Effects of complex media loads on plastic materials in fuel cell systems (housing, membranes ...)
- Plastic components in high-pressure hydrogen tanks
- Influence of pressurized hydrogen on the mechanical behavior of plastic liners
- Mechanical behavior and aging of elastomeric sealing materials

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Fraunhofer Institute for Structural Durability and System Reliability LBF

Contakt

Dr. Felix Dillenberger
Group Manager
Mechanics and Simulation
Phone +49 6151 705-8753
felix.dillenberger@
lbf.fraunhofer.de

Fraunhofer LBF
Schlossgartenstr. 6
64289 Darmstadt, Germany

Tailormade. Reliable.

Polymers in Hydrogen Technologies

Polymer Materials for Components in Hydrogen technology

Hydrogen technology is finding its way into various areas of technology, such as energy production and storage as well as transportation, automotive and aviation sectors. To implement reliable and safe systems, it is necessary to ensure that all components are designed to work together and that suitable materials are used.

Various plastic materials are applied in hydrogen applications. These include e. g. fiber-reinforced thermoplastics for housing components in fuel cells, elastomers in seals and thermoset composites used in high-pressure tanks.

Concerning hydrogen application, the Fraunhofer LBF conducts research, starting at the material and sample level and extending to the overall system level: for thermosets, elastomers and thermoplastic materials. We provide our partners with advice and support on all issues in this context.

Specimen and part tests

When testing specimens and components, it is essential to take into account the relevant factors influencing the material properties. These include the influence of hydrogen, but also other media used in connection with hydrogen technology, such as cooling media and water in fuel cells.

The operating temperatures and pressures are of considerable relevance with regard to the plastics properties. Similarly, the mechanical loads in such systems are very diverse. These can act under different load speeds and frequencies, for example, quasi-static, cyclic or short-term crash loads. Material aging, as well as creep and fatigue behavior also play an essential role in system design.

The Fraunhofer LBF offers a wide range of customized, application-oriented tests and characterization methods

- Mechanical testing: Static, creep, fatigue, crash (also insitu in different media and hydrogen)
- Structural monitoring and damage detection
- Analytical methods: microanalysis (computed tomography), molecular analysis, swelling
- Aging and interaction testing: Media, pressures and temperature
- Method development for leakage measurement in seals

> "Based on our many years of experience, we develop methods for designing safe and reliable plastic components – under complex loads in the context of hydrogen technology."
>
> **Dr. Felix Dillenberger,**
> Group Manager Mechanics and Simulation

Material design

In order to cope with the increasingly complex applications, the Fraunhofer LBF will be pleased to support you in the

- Selection of suitable materials
- Qualification of materials
- Material-appropriate processing
- Modification of materials

Fraunhofer LBF has many years of expertise in the development of formulations, additives and fillers to ensure processing and application-specific properties..

Component design

For a material- and load-oriented, reliable component design, it is necessary to adequately consider the interactions that can occur in the field of hydrogen technology. FE simulations enable the prediction of performance, and thus targeted use of materials and efficient component design.

In this context, it is crucial to determine adequate material data and simulation strategies. Especially in the case of superimposed loading mechanisms and anisotropic materials, such as fiber-reinforced plastics, this represents a challenge.

The Fraunhofer LBF offers wide support in this context, based on many years of experience in the development of methods for anisotropic nonlinear structural and processing simulations under consideration of complex interactions.