aerospace & advanced composites

AEROSPACE & ADVANCED COMPOSITES GMBH

Fiber compounds: Simulation and Testing

Targeted Markets

Key areas of consulting, testing, research and development activities:

Space
- ESA Testhouse
- Material testing
- Flight hardware testing

Aeronautics
- Composite process development
- Anti-Ice coatings

Energy
- Solar Energy - Modules
- Wind Energy - Coatings

General Industry
- Selected product development

Our product focus is on material testing and material development for highly specialized niches in Aerospace and terrestrial applications

aerospace & advanced composites

Products and Services

Consulting

- Simulation
- Materials and processes

Testing

- Material and component level
- Customized testing in extreme environments

Development

- Products and processes

Research

- Partner in national and international projects

Our product focus is on material testing and material development for highly specialized niches in aerospace and terrestrial applications

aerospace & advanced composites

Cellulose Based Composites (CBC)– Areas of Application

Cellulose Based Composites

- Composition:

  Combination of cellulosic fibers and a binder
  Fibers are a natural part of plants and consist of long chains of glucose molecules.
  Binder can be made of various materials such as resin, glue or natural rubber

- Advantages:

  Good strength and rigidity while being lightweight
  Biodegradable depending on the resin used

Cellulose Based Composites – Application Based Resin Selection

Resin Selection

- Epoxy resin:

  High strength & good adhesion to the cellulosic fibers
  Aircraft, construction and automotive industry

- Polyester resin:

  Easy to process & good chemical resistance
  Widely used in boat manufacture and in the manufacture of moldings

- Phenolic resin:

  High hardness & high temperature resistance
  Electronics industry

- Vinyl Ester Resin:

  Similar to polyester resins but higher resistance to chemicals and moisture
  Waste water treatment or in the chemical industry

Cellulose Based Composites – Application Based resin selection

Biobased Resin alternatives for biodegradable Composites:

1. Starch:

   Can be obtained from corn, potatoes or other plants
   Biodegradable

2. Lignin:

   Waste product of paper manufacture
   Can be used as a binder for composite materials

3. Polylactic acid (PLA):

   From renewable resources such as corn starch
   Particularly suitable for applications in the packaging industry.

4. Polyhydroxyalkanoates (PHA):

   Produced by microorganisms
   Can be obtained from organic waste or plant materials

Simulation of Composites

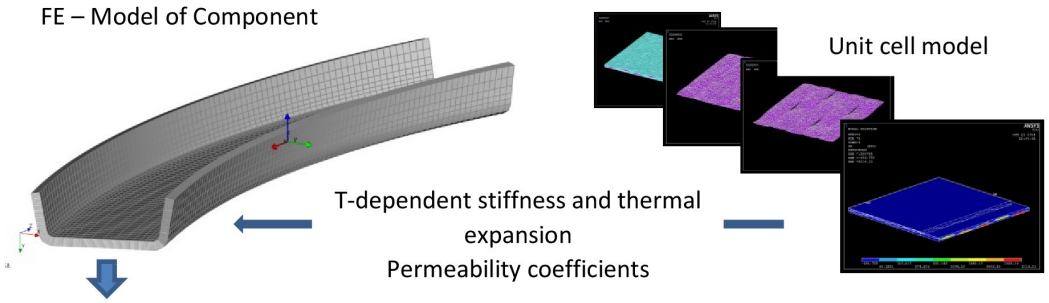
Composite Process Simulation

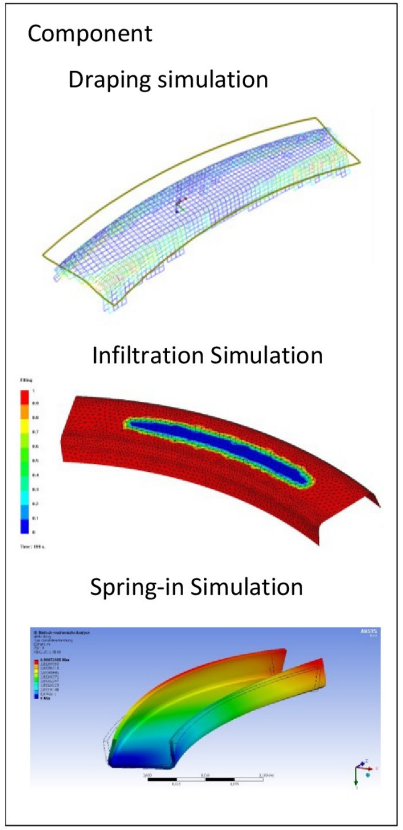
Modelling of mold behaviour

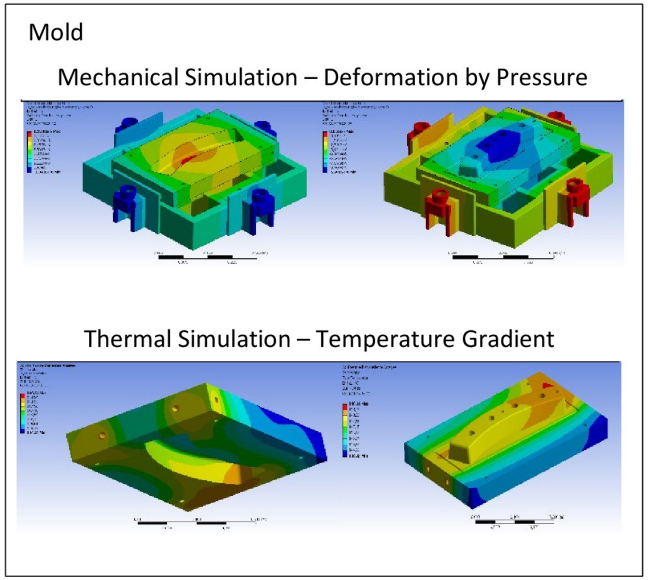
- Transient Thermal behaviour
- Deformation under infusion pressure

Modelling of part

- Unit cell based material properties
- Draping of dry preforms - shearing
- Infusion of part – dry spots
- Spring in behaviour - distortion







aerospace & advanced composites

Monitoring of Composites

Integrated Process and Health Monitoring

Sensor Development

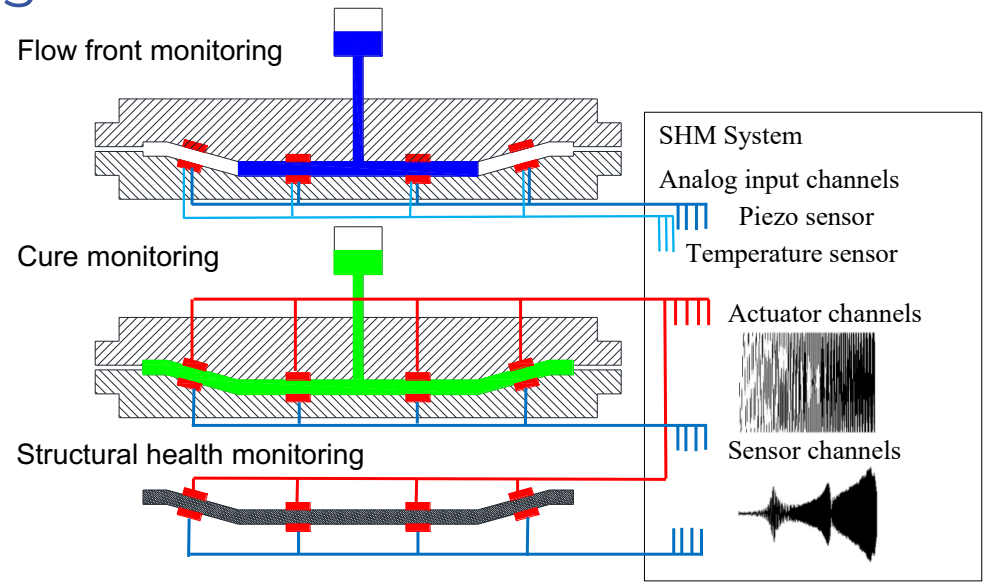
- Integrated Piezo Temperature Sensor

Process Monitoring

- Change of impedance of piezo by resin
- Monitoring of resin front during infusion
- Monitoring of degree of cure

Health Monitoring

- Passive damage detection by acoustic emission
- Active damage detection of guided ultrasonic waves
- Compensation of thermal effects by temperature measurement



aerospace & advanced composites

Cryogenic Testing of Composites

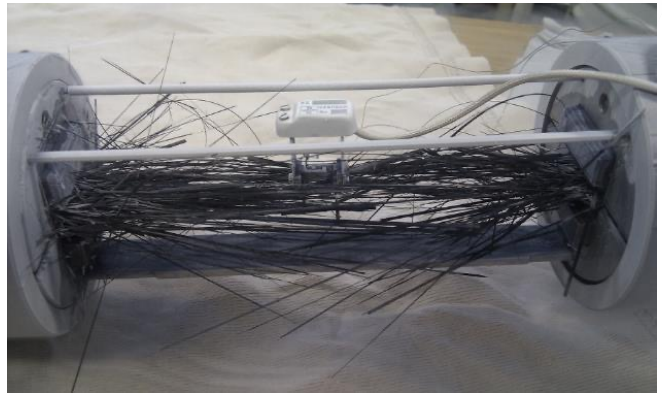
Composite Materials for Cryogenic Tanks

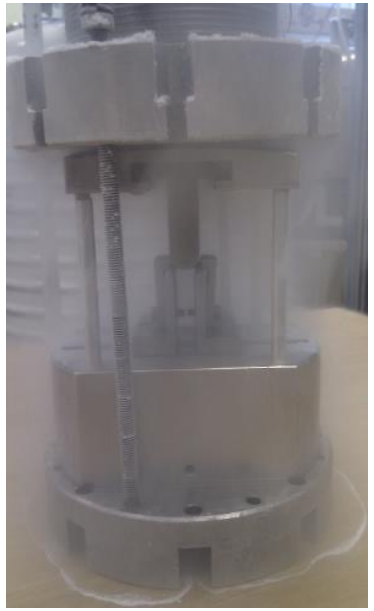
Monolitic composites

- Tensile
- In plane shear
- Compression
- Interlaminar Shear
- Bearing

Honeycombs

- Flatwise tensile
- Flatwise compression
- Shear



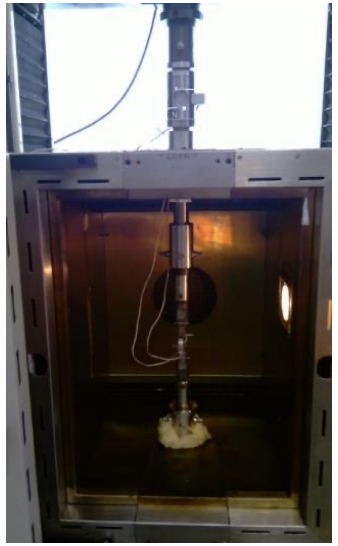


aerospace & advanced composites

Mechanical Properties

from Cryogenic to High Temperatures

Property / Test method	Environment
Tensile testing • Tensile strength • Young´s Modulus	-269 … 1100°C
Compression tests • Compression strength • Compression Modulus	-269 … 1100°C
Bending tests • Bending strength • Bending Modulus • 3-pnt and 4-pnt bending	-269 … 1100°C
Charpy Impact Test	-196°C / RT
Fracture Mechanic Properties • KIC, KJC, J-Integral • Fatigue crack growth	-269 … 1100°C
Special Composite Properties • ILSS • Two Rail Shear • TestPicture frame test	-269 … 1100°C



Climate chamber
-150°C … 600°C

LN2 cryostat
-196°C

LHe cryostat
-269°C

AAC
aerospace & advanced composites

References

Industrial partners:

AAC
aerospace & advanced composites

aerospace & advanced composites

Aerospace & Advanced Composites GmbH

A-2700 Wiener Neustadt
Viktor Kaplan-Straße 2
Austria
Tel.:+43 2622 90550-0
Email: office@aac-research.at
www.aac-research.at

Follow us on LinkedIn