Composites: new material models for REHAU

Safe and extremely strong: modern composites take over in car manufacturing. REHAU develops production procedures which increase the use of these lightweight materials. TECOSIM assists in this process by calculating and simulating a variety of material values.

CHALLENGE
Less weight means less fuel consumed, fewer CO2 emissions and greater travel ranges, essential in view of an electric vehicle future. Material cards are becoming considerably more important in the development of new, lightweight composites. These cards contain all material properties and provide information on how a material reacts to external influences in terms of damage such as crack and dent formation and on the extent of such damage. REHAU was faced with the following challenges:

- Producing three material cards for three new composite types
- Frequent variations in test results
- Completion and evaluation of tests in a temperature range between -40 and +90 degrees

SOLUTION
TECOSIM took responsibility for managing and coordinating the universities which also helped with testing for this ambitious development project. TECOSIM produced material card models for three composites, on which the behaviour of different external influences could be precisely mapped up to the point where the materials deform.

"As a future-oriented company, REHAU works to optimise its CAE processes on a continuous basis. Working together with TECOSIM helped to achieve this goal and delivered excellent results."
Tobias Tuchbreiter, CAE Engineer, REHAU AG

PROJECT DESCRIPTION INFO BOX
- Management and coordination of the participating universities
- Calculation and simulation of informative material models
- Minimisation of variations in test results
- Creation and validation of material cards

REHAU AG + CO.

As a premium brand for polymer-based solutions, REHAU is a global leader in the construction, automotive and industry sectors. Some 20,000 employees at 170 locations worldwide are actively committed to ensuring the success of this independent family firm based in Rehau, Germany.

More Information: www.rehau.com
TECOSIM SERVICES
Calculating plastic deformation
If a composite component does not return to its original position when a load is removed, permanent plastic deformation has occurred. TECOSIM calculated the specific load values for the point where the permanent change in material properties first takes place. The exact point where permanent plastic deformation occurs was identified using tensile tests and three-point bending tests with special thermal imaging recordings. This point was then entered into the material card models.

Achieving valid test results
Composites often exhibit product characteristics which cause a very disparate variation between the results of individual repeat tests. TECOSIM took this into account and incorporated the direction of moulding for the composite samples into the simulation. TECOSIM also applied this knowledge to tests in five different temperature fields in a range between -40 and +90 degrees.

Creation and validation of material cards
The realistic simulation of composite components under quasistatic, thermal or crash loads requires a detailed description of the material’s behaviour in the form of a material card. TECOSIM recorded and analysed the test results and combined the specific material values for three innovative composites on a material card.

CLIENT BENEFIT
TECOSIM impressed as a solution-oriented project partner. The company delivered high-grade material models based on the final validation results. REHAU used the simulation to establish a quickly implemented, informative approach to further development using real components. After the created material models based on the material cards are validated, the models can then be used to design components, thus reducing development times even further.

RESULTS
- Tensile and three-point bending test successful
- Material cards can be used for five different temperatures
- Use of data in ABAQUS material models

TECOSIM COMPANY PROFILE
TECOSIM is a leading development partner in computer-aided engineering (CAE) on the global market with twelve locations in five countries. This specialist in numerical calculation and simulation completes challenging tasks in system simulation, structure simulation, fluid dynamics and multi-body system simulation with the aid of its 440 employees worldwide.

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