

Damage behavior of highly porous ceramics

CUSTOMER: bime (Bremen Institute for Mechanical Engineering)

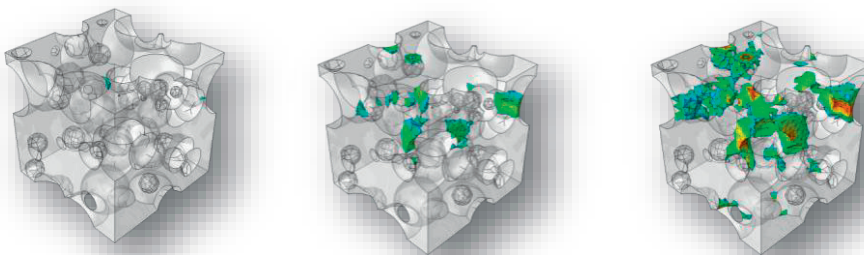
- Investigates mechanical and damage behavior of materials and structures
- Develops manufacturing plants and their control techniques
- Provides production logistics management solutions

CHALLENGE

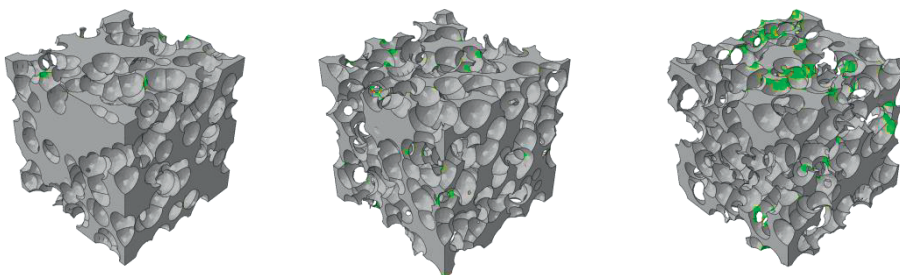
- In-depth investigation aiming at material design
- Prediction of elastic properties of porous sound absorbing ceramics
- Prediction of pure brittle damage with respect to microstructure

HOW CAN DIGIMAT TACKLE THESE CHALLENGES?

Pure brittle damage development in a porous ceramic RVE (30% porosity)



Influence of porosity on pure brittle damage of the RVE (50% - 60% - 70%)



DIGIMAT SOLUTION

- Reverse engineering of the unknown material properties based on experimental results
- Virtual compounding of different porous ceramics in Digimat-MF
- In-depth micro investigation of porous ceramics by Digimat-FE
- Numerical investigation of pure brittle damage at both micro and macro scales on the porous ceramics

RESULTS

- Reduced cost of material production and characterization
- Increased material strength with improved material design
- Boosted cooperation between ceramic developer and acoustic user

MATERIALS

Ceramics

PERFORMANCES

Stiffness, Failure, Sound absorption

DIGIMAT

Digmat-MF, Digimat-FE

CAE TECHNOLOGY

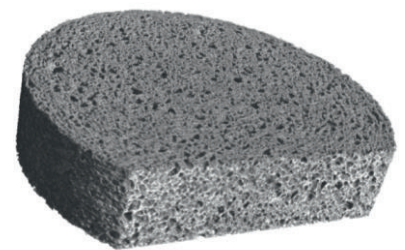
Abaqus Standard

INDUSTRY

Energy, Aerospace

APPLICATION

Material design



CT scan of ceramic sound absorber.
Courtesy of Frank Giese, ZARM.

"The application of Digimat-MF and Digimat-FE paved the way for me to give an insight into the influence of microstructure on the overall mechanical and brittle damage behavior of highly porous sound absorbing ceramics. I was able to contribute to the improvement of material strength by new material design while keeping the good sound absorption."

Reza Malekmohammadi
Research Assistant, bime
www.bime.de

The nonlinear multi-scale material & structure modeling platform

Digimat material modeling platform means developing innovative, optimized and cost-effective products. As a unique nonlinear multi-scale material and structure modeling platform, Digimat offers:

Digimat MF: Mean-Field homogenization software used to predict the nonlinear behavior of multi-phase materials.

Digimat FE: Finite Element based homogenization software used to model the nonlinear behavior of Representative Volume Elements (RVE) of material microstructures.

Digimat MX: Material eXchange platform used to prepare, store, retrieve and securely exchange Digimat material models between material suppliers and end-users.

Digimat CAE: Digimat linear and nonlinear interfaces to major processing and structural FEA software to enable multi-scale analyses of composite structures.

Digimat MAP: Shell & 3D mapping software used to transfer fiber orientation, residual stresses and temperatures between dissimilar processing and structural meshes.

Digimat RP: Easy and efficient solution for the design of fiber reinforced plastic parts.

Digimat HC: Easy and efficient solution for the design of honeycomb sandwich panels.



MSC Software Company

The material modeling company

e-Xstream engineering is a provider of simulation software & engineering services, 100% focused on advanced material modeling. e-Xstream was founded in 2003 in Belgium and Luxembourg. e-Xstream is an MSC Software company since September 2012 with more than 1100 associates working from over 20 offices around the world.

e-Xstream engineering develops and commercializes Digimat – the nonlinear multi-scale material and structure modeling platform that fastens the development of optimal composite materials and parts.

Digimat customers are material experts and structural engineers who accurately predict the behavior of multi-phase composite materials and structures. Digimat is used by all major material suppliers and users across all industries (Automotive, Aerospace, Electric & Electronics, Leisure, Defense ...).

With this important customer base worldwide, e-Xstream combines deep expertise in material modeling and numerical simulations with the business understanding of the large variety of materials used across all industries.

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