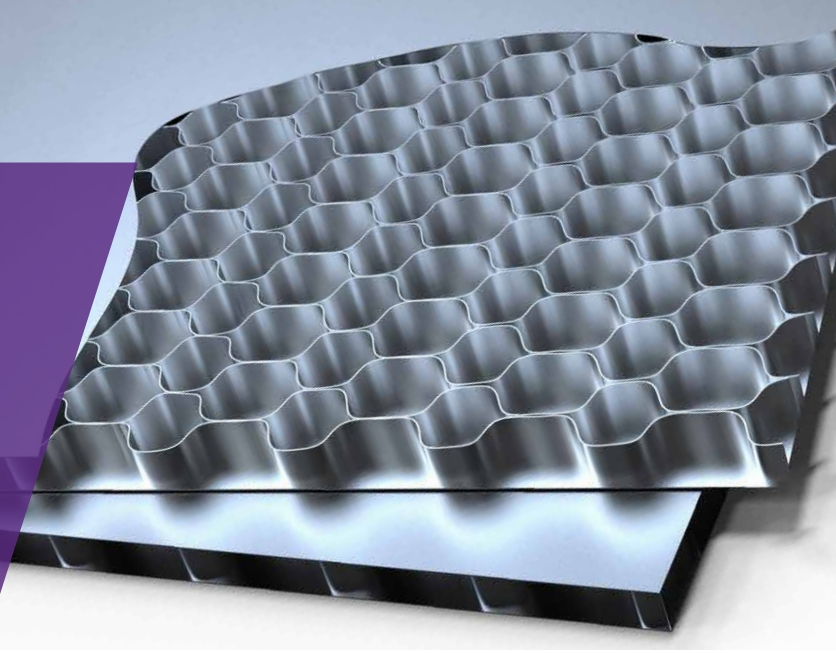
SYNOPSYS®

Simpleware Software for Composite and Material Charaterization



Key Benefits

- Intuitive, User-Friendly Interface
- Quick and Accurate Segmentation
- Advanced 3D Image Processing
- Export High-Quality Meshes for Simulation
- Develop Automated Workflows
- Expert Technical Support

Key Features

- Import Images from Multiple Modalities
- Wide Range of Image Filters and Segmentation Tools
- Measurements and Statistics
- Automated Multi-Part Meshing
- Export to FE and CFD Packages

Why Simpleware Software?

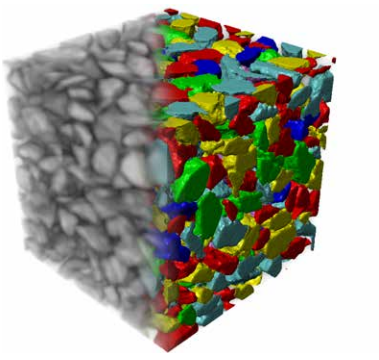
Simpleware™ software offers a fast, easy-to-use solution for processing 3D image data in composite applications. Use the software to visualize and quantify complex multiphase materials and their microstructure. Rapidly characterize your 3D data, and export robust volume meshes for FE/CFD simulation. The software allows you to quickly generate valuable models for research and development into how materials function and fit into broader design and manufacturing processes.

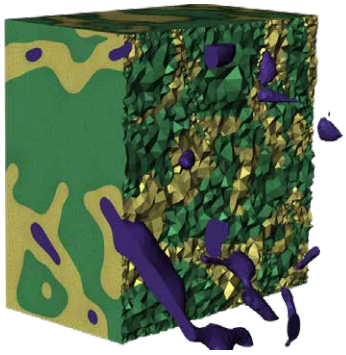
Intuitive and Customizable

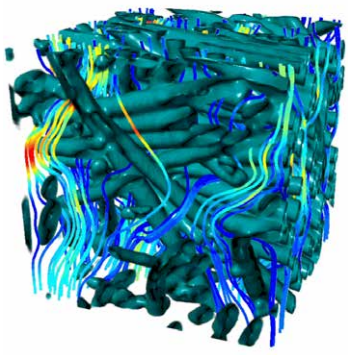
We pride ourselves on the ease-of-use of Simpleware software. Users new to the software can start processing image data within a short time frame, and very quickly visualize and identify regions of interest. Our range of fully automated, semi-automated and interactive segmentation and measurement tools allow even the most challenging image datasets to be processed and characterized efficiently. The software also offers scripting tools and plug-ins for users to customize the software and automate repeatable tasks.

Dedicated Support and Training

Our expert technical support team are here to help you get the most out of the software, including step-by-step guidance and personalized support. We also regularly offer classroom training courses at our offices, or you can arrange customized training sessions online or at your site.







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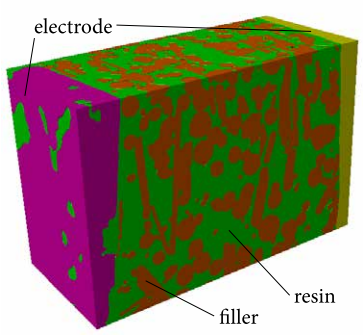
Pathway between Electrodes in Conductive Adhesive

O. Arao • A. Shintai • A. Sugiura, ***DENSO Corporation, Japan***

Isotropic Conductive Adhesives(ICA) conducting electrically and thermally through metal fillers in resin have been studied macroscopically and microscopically. In this example, image-based meshing of FIB-SEM was used to firstly generate a 3D model which allowed for the observation of the dispersion and conductivity of the pathway. In addition, thermal conduction and electric conduction results are also analyzed. It was found that the electric and thermal interface resistance can be calculated by the comparison of analysis and experiment. Thermal and electric interface resistance quantified by this study would make ICA higher thermal conduction and electric conduction.

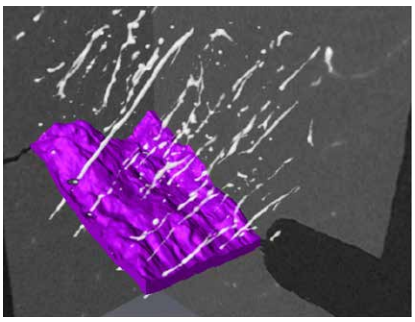


Microstructure of conductive adhesive: segmentation of different elements

Effects of Micro-rods on Fatigue Crack Growth

J. Hochhalter, ***NASA Langley Research Center, USA***

Directional solidification of an Al-Cu alloy using the Bridgman method was employed to study fatigue crack growth in single- and bi-crystal specimens. Images obtained from X-ray Micro-CT were imported in Simpleware software. It was observed that some of the Cu segregated during fabrication, forming micro-rods. Grayscale image segmentation was done to define the separation of the matrix (Al-Cu), Cu-rich micro-rods, and air (notch and propagated crack). Analysis was carried out on 5000 cpu cores at the NASA Advanced Supercomputing facility. Results show that the inherent machining irregularities at the notch and the geometrical complexities of the micro-rods strongly influence regions of stress concentration.

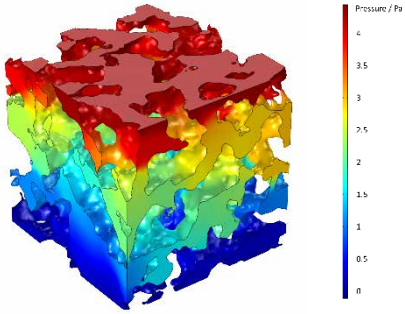


Micro-CT scan of fatigue crack (purple) in Al-Cu alloy with Cu-rich micro-rods (white)

Modeling of Diesel Particulate Filters

J. Dean • A. Houston , ***Double Precision Consultancy, UK; University of Cambridge, UK***

Strict emission limits on diesel engines have necessitated Diesel Particulate Filters (DPFs) to be included in the exhaust stream. Simpleware software is applied to solve the challenge of characterizing the pore architecture, tortuosity and permeability of novel diesel particle filters, with results used to optimize filtration efficiency. Simpleware ScanIP was used to reconstruct complex 3D pore structures from X-ray microCT data prior to meshing and export to COMSOL Multiphysics®. The passage of gas and diesel particulate through the structure was simulated, and results are being used to help optimize microstructure to improve filtration efficiency (alongside improvements to thermal shock resistance).

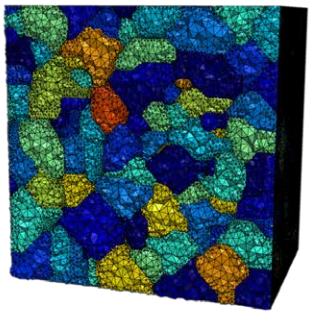


Steady-state pressure field through volume modeled in COMSOL Multiphysics®

Local Stress Fields Analysis in a Microstructure

R. Saunders[1] • A. Bagchi[1] • A. Achuthan[2], ***[1]Naval Research Laboratory, USA; [2]Clarkson University, USA***

Metal power-based additive manufacturing (PAM) processes typically result in microstructures with a texture and columnar grains of different sizes, which affect the mechanical properties of the material. In this work, a method is developed to better represent the local granular stress fields within the microstructure. Digital images from a synthetic microstructure are converted in Simpleware software into a shape preserving FE model with a microstructure-informed constitutive model that describes the mechanical behavior of solidified material produced by PAM. This method allows the local stress intensification to be better captured in the vicinity of the grain boundary and helps with the prediction of defects and void formation in the material.



Mesh of a synthetic microstructure representative volume element (RVE)

For more information on Simpleware Software Solutions go to www.synopsys.com/simpleware

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