

Complex fibre analysis using X-ray imaging

ROCKWOOL International A/S is part of the ROCKWOOL Group which is the world's leading supplier of innovative products and systems based on stone wool. To characterise complex fibre materials, ROCKWOOL collaborated with the 3D Imaging Centre at DTU. By performing micro X-ray computed tomography, the internal fibre structure of the stone wool samples was visualised. Tools for automatic characterisation of the fibre networks were developed in close collaboration between the 3D Imaging Centre at DTU and ROCKWOOL. The explorative analysis offered the company novel knowledge about their material properties.



ROCKWOOL's insulation material.

Challenge

Mineral wool consists of fibres arranged in a complex network. The fibres can vary in diameter, length, orientation and curvature. All these parameters influence the final material properties, hence characterising them helps to understand and thereby tune the material properties.

Collaboration

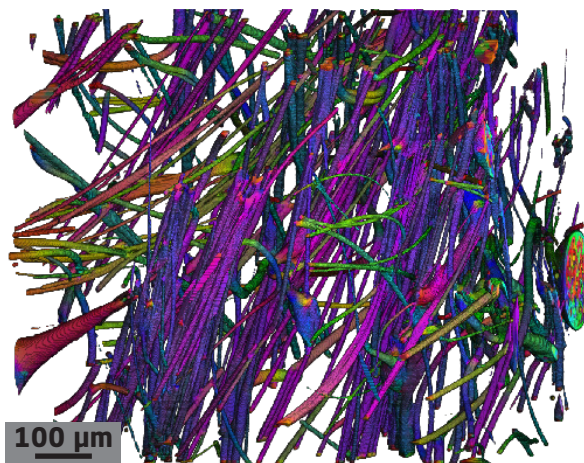
Through the collaboration between ROCKWOOL and the 3D Imaging Centre at DTU, the material was characterised using micro X-ray computed tomography scans and an analysis toolbox was developed in-house. This collaboration was part of the LINX project in which researchers at leading Danish universities collaborate with scientists in industry to solve industry relevant problems using advanced neutron and X-ray techniques.

Results

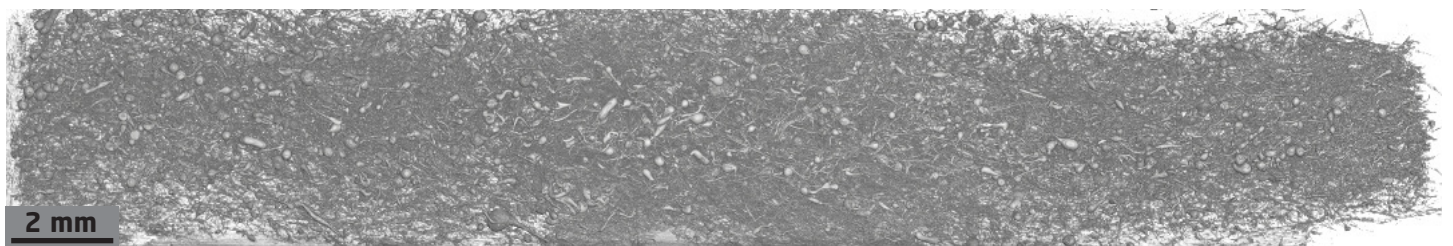
By performing several high resolution scans along the assumed dominating fibre direction, a large field of view was analysed without compromising visibility of individual fibres. The developed analysis is based on the estimation of local orientations which are used to track and characterise individual fibres. It involves handling large amounts of data, detailed visualisations of the inner structure of mineral wool, and an analysis of material parameters such as orientation and diameters.

Perspectives

By this characterisation of the fibres, ROCKWOOL could gain valuable input for simulations. Having this analysis toolbox enables similar analyses of future products.



3D rendering showing the orientations of the fibres in a high resolution X-ray CT scan after orientation analysis.



3D-rendering of the insulation material. The image is set together from 6 individual scans in order to probe a long part of the sample while at the same time keeping a high resolution with a voxel size of $4.95 \mu\text{m}^3$. The inspection from this perspective only gives a glimpse of the complex structure of the material with tightly packed non-oriented fibres of different diameters.

Imaging Industry Portal

The Imaging Industry Portal is a part of the 3D Imaging Centre at DTU and assists companies in using and implementing 3D Imaging in research, development and production. The portal offers research-based 3D Imaging services and provides companies with the latest equipment and the most advanced knowledge within 3D Imaging and data analysis. The Imaging Industry Portal works as a gateway to ESS and MAX IV, as well as other large scale facilities.

www.imaging.dtu.dk/Industry-Portal

DTU 3D Imaging Centre

