

# **The GeoDict Virtual Material Laboratory:**

## **Integrated Software for Material Characterization and Material Engineering**

**Abstract Author(s):** Erik Glatt; Andreas Wiegmann;

**Contact Author:** Erik Glatt

### **Abstract:**

The dependence of macroscopic material properties on the microscopic material geometry is emerging as a key aspect in many current material optimization applications. From fiber orientation and strut-thickness of sponges to effective stiffness and permeability tensors, the influence of geometry on the properties is omnipresent. The GeoDict Virtual Material Laboratory is a generic approach to integrate the characterization of existing materials and the engineering of new materials. By basing the computation of material properties on 3d images, the ready availability of  $\mu$ CT images can be exploited as well as the relative ease of creating 3d images from analytic representations and surface triangulations of the micro-structures.

Several powerful concepts are available: a scripting language for parameter studies and optimization studies. A generic description language of analytic data, together with conversion algorithms to surface triangulations and segmented 3d images. A multitude of integrated tools to convert abstract descriptions such as fiber diameter distribution, fiber orientation distribution and solid volume fractions into concrete 3d images, so-called realizations, and last but not least a multitude of integrated tools to predict material properties based on the geometry and constituent material properties.

The prediction of material properties on the micro scale is the basis of accurate simulations of macroscopic properties. The permeability simulation based on a drill core helps to understand the flow through a whole oil reservoir. The simulation of elasticity tensors based on fiber orientation leads to a better prediction of the strength of fiber-reinforced materials. See [www.geodict.com](http://www.geodict.com) for more details.