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Added value of micro-tomography measurements in mechanical characterization of materials: some case studies in engineering applications

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ABSTRACT

The research group *Mechanics of Materials and Structures* at Ghent University in Belgium is doing research on the experimental and computational mechanics of (composite) materials. Micro-tomography is used as a measurement tool to improve insight in mechanical testing and to provide input for finite element simulations.

In this contribution, several case studies in engineering applications will be discussed:

- Laminated glass is widely used in all building applications. The EN12600 standard is a testing standard to assess the resistance of laminated glass against "human impact", as it frequently happens that people accidently walk into a glass door or tumble into a large glass window or glass fence. As the "human impact" should be replaced by a standardized impactor, an inflated rubber tyre is used to that purpose. In modelling the EN12600 standard, the interaction of the tyre with the laminated glass is important. Micro-CT imaging has been used to reconstruct the tyre model (Figure 1),
- All large OEM companies in automotive industry are actively doing research on weight reduction of cars. One of the considered options is (partially) replacing metallic components by composite components. However, cycle times in automotive industry are extremely short (about 1 minute per part) and 50,000 to 100,000 parts per year are target numbers that should be reached. Therefore, novel composite material combinations have to be designed that can be processed very fast. Figure 2 shows a dry 3D woven fabric with commingled glass/polyester yarns that can be consolidated very fast in a heated press. The Micro-CT images are used to characterize the fabrics and reconstruct the "as-woven" geometry,
- Figure 3 shows a CT-scan of a 3D printed PA12 (polyamide-12) material. In this research, relations are sought between the internal microstructure of the 3D printed material, the sequence of layer-by-layer deposition and the resulting mechanical properties of the 3D printed material.

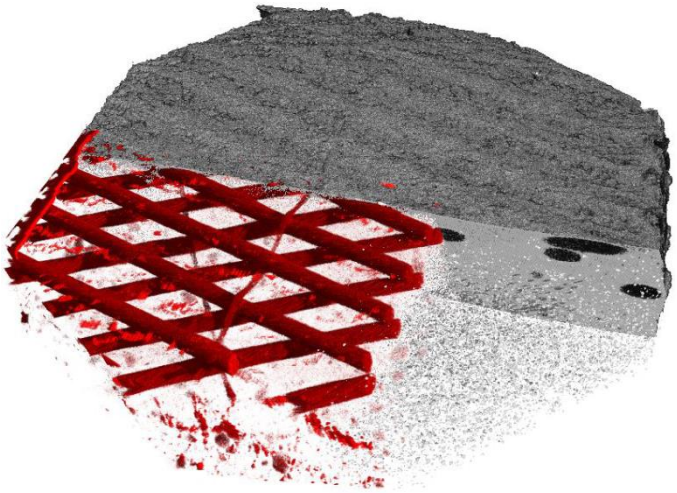

Figure 1: Micro-CT scan of tyre for impact of laminated glass

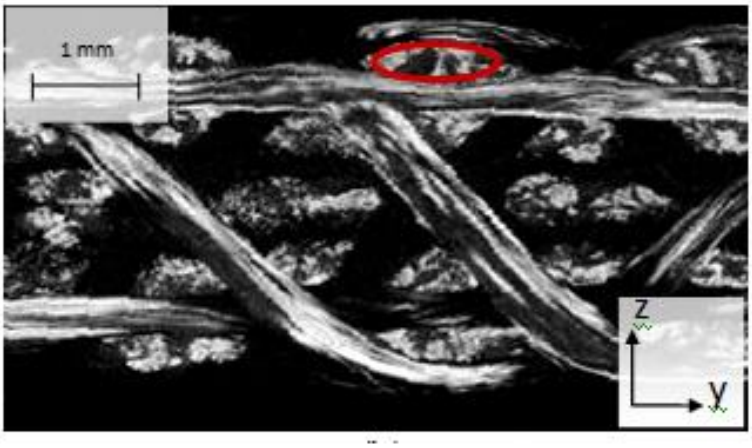

Figure 2: Micro-CT scan of 3D woven dry fabric for automotive applications

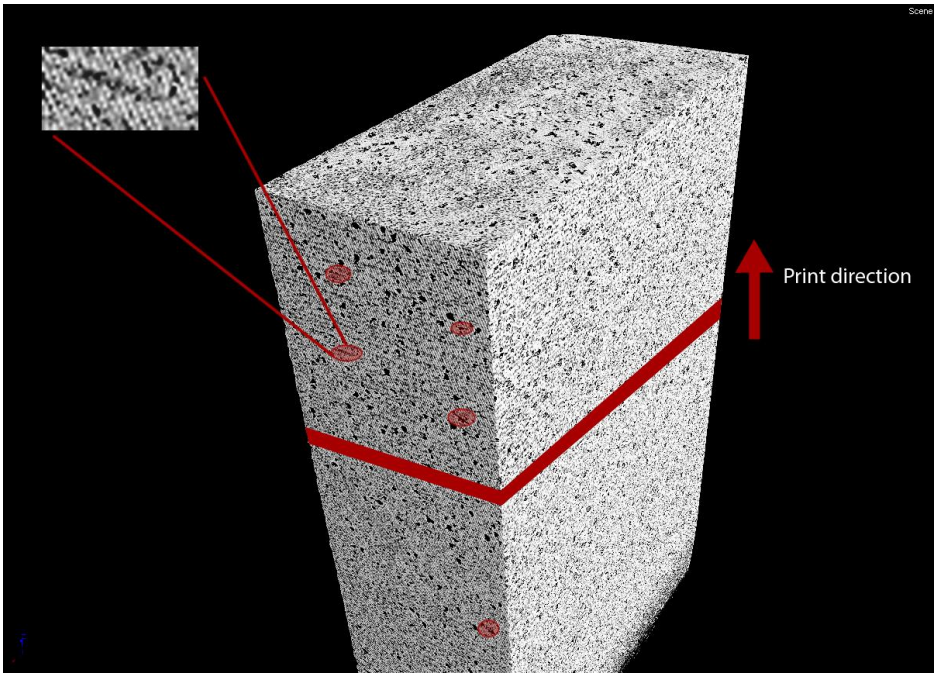

Figure 3: Visualization of porosity content in 3D printed materials