OUR EXPERT TEAM

Mechanics of Materials and Structures Group

Focuses on characterizing a wide range of materials such as polymers, composites and metals to better understand their behavior like general mechanics and fatigue, also developing novel tools for NDT/NDE of materials and process simulation. Moreover, developing design and modelling approaches for additive manufactured implants and prosthetics/ orthotics.

PROF. WIM VAN PAEPEGEM

PROF. MATHIAS KERSEMANS

Polymer Chemistry and Biomaterials Group

Focuses on the development of polymers for mainly biomedical applications including tissue engineering, drug delivery, wound healing, organ-on-chip applications, etc. The main research pillars are focusing on polymer synthesis, functionalization, processing (extrusion, DLP, SLA, 2PP and volumetric 3D-printing) and characterization of the polymers as well as the processed structures.

PROF. SANDRA VAN VLIERBERGHE

PROF. PETER DUBRUEL

Centre for Polymer and Material Technologies

Focuses on advanced polymer processing technologies with in depth experience in both simulation and experimental rheology analysis. Moreover, studies the selection and development of new polymer/ composite based materials for powder bed fusion and extrusion 3D printing technologies.

PROF. LUDWIG CARDON

PROF. FLÁVIO H. MARCHESINI

Laboratory of Pharmaceutical Technology

Focuses on the development of innovative drug dosage forms (mainly solid dosage forms) for human application as well as for veterinary use. These dosage forms are based on pharmaceutical accepted excipients used as such or as mixtures to impart specific drug release properties (immediate, controlled or sustained release) to the formulation.

PROF. VALÉRIE VANHOORNE

PROF. CHRIS VERVAET

Tissue Engineering and Biomaterials Group

Focuses on addressing cell and tissue microenvironment and oxygenation in multicellular spheroid and organoid-based biofabricated constructs, using luminescent biosensors, recombinant proteins and multi-parameter live fluorescence microscopy approaches.

PROF. RUSLAN DMITRIEV

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ENABLING HEALTH INNOVATIONS

United Nation's sustainable development goal number three states that **"Ensuring healthy lives and promoting well-being at all ages is essential"**. Based on that UGent is keen on exploring state of the art technologies to be in a leading position for achieving this goal. One of the main technologies being developed and used today in the health care sector is **Additive Manufacturing** also know as **3D printing**. This is because of its potential in revolutionizing the world of personalized medicine and patient-specific medical devices.

3D printing shows unique capabilities when it comes to **customization, personalization** and **on-demand production**. In many cases this technology offers **reduction** in **production cost** and **lead time**.

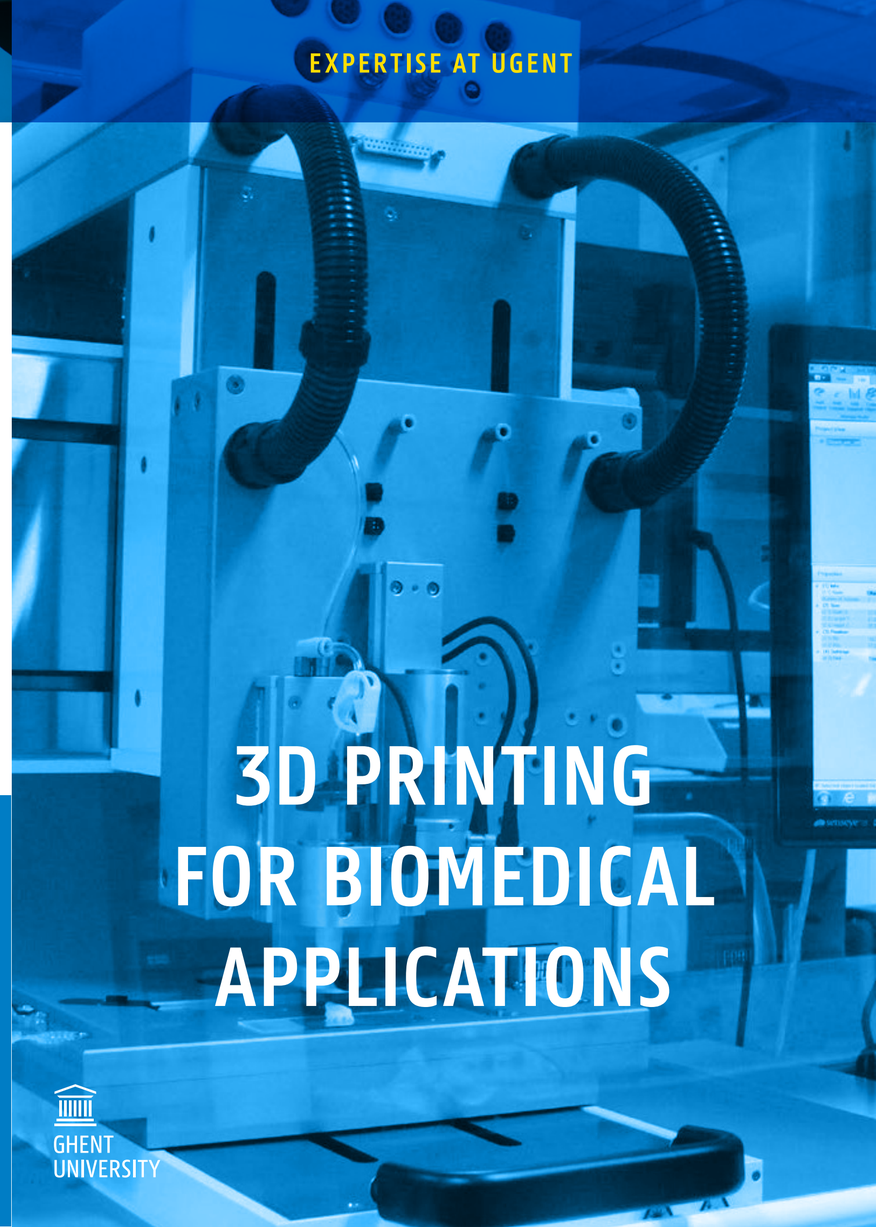
Research and development is being conducted using 3D printing for many applications such as but not limited to:

- **drug delivery system,**
- **biomedical devices,**
- **tissue regeneration**
- **organ-on-chip.**

This is done through intensive research in the field of:

- **material development** (soft/hard polymer, hydrogels, ceramics, ...),
- **process development** (3D printing technology, modelling and structural design, ...)
- **testing and validation** (mechanical properties, biocompatibility, application suitability, ...).

EXPERTISE AT UGENT



3D PRINTING FOR BIOMEDICAL APPLICATIONS

GHENT UNIVERSITY

OUR TOOLBOX AND OFFER

Our 3D printing toolbox

Extrusion-based technologies (Fused Filament Fabrication, FDM®)

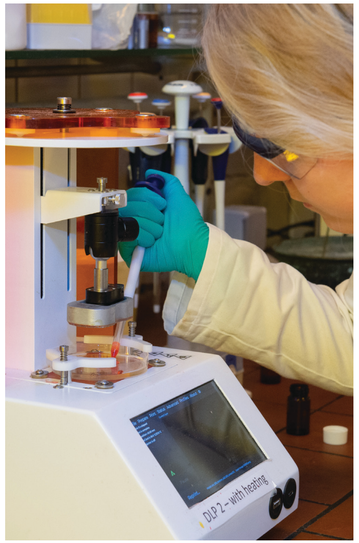
A wide range of extrusion-based 3D printing equipment capable of processing materials in the form of filament, pellets and powder. Additionally, an in-depth experience and knowledge in processing polymers and composites.

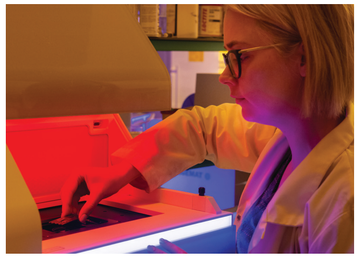
Vat photopolymerization technologies (SLA, DLP, 2PP)

Different state of the art technologies such as Stereolithography, Digital Light Processing, Two Photon Polymerization, Volumetric 3D Printing are available for the research and development of new materials and applications. Moreover, the ability of fabricating structures down to micrometer scale for a wide range of applications in the medical sector with outstanding precision and accuracy.

Powder bed fusion technologies (Selective Laser Sintering)

For processing polymeric material via laser sintering techniques, several machines are available with the ability to control the process parameters in order to achieve optimum product quality.





Our multidisciplinary offer

Design and Modelling

- Knowledge in numerical analysis (Multi-scale modelling, Topology optimization)

Materials selection and development

- Novel polymers and biomaterials development (natural and synthetic polymers, bioinks, ceramics)
- Screening and development of formulation (Active pharmaceutical ingredients, processability testing, evaluation of processing parameters)
- Characterization of different material properties (Molecular characterization, chemical and thermal properties, biocompatibility)

Testing and validation

- Experimental mechanics (Static, Fatigue, Fracture mechanics, Micromechanical testing)
- Non-Destructive testing (Ultrasound, Process compensated resonance testing, X-ray computer tomography)
- Surface visualization and characterization (Microscopy, Wettability, Interaction)

OUR OFFER

EXTRUSION-BASED TECHNOLOGIES (FUSED FILAMENT FABRICATION, FDM®)

VAT PHOTOPOLYMERIZATION TECHNOLOGIES (SLA, DLP, 2PP)

DESIGN, MODELLING, TESTING AND VALIDATION OF BIOMEDICAL DEVICES

PERSONALIZED PHARMACEUTICS

BIOPRINTING, TISSUE ENGINEERING, ORGAN-ON-CHIP AND BEYOND

OUR EXPERTISE

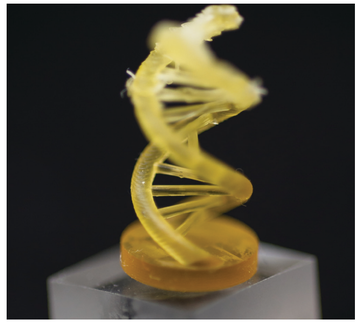
Design, modelling, testing and validation of biomedical devices

Our expertise within UGent covers the work flow of producing 3D printed medical device from design up to testing. Starting from analyzing patients' captured data such as MRI and CT scanning to designing and modelling the required device. Our researchers have gained the know-how and skills to develop models that can help understanding the behavior of the designed devices under different conditions via advanced numerical simulation tools. This enabled us to develop design and modelling approaches specifically for implants and prosthetics/orthotics produced via 3D printing technologies. Furthermore, our well-developed infrastructure allows us to conduct the necessary experimental testing to validate the performance and behavior of such devices. This includes advanced high resonance techniques for nondestructive testing of 3D printed structures.

Bioprinting, tissue engineering, organ-on-chip and beyond

Our researchers have extended know-how in the field of soft/hard material development and processing. We have specific expertise related to the functionalization of polymers with (photo-) crosslinkable moieties. This has been achieved for both extrusion-based and Vat photopolymerization bioprinting technologies. Tissue engineering (orthopedic, ocular, adipose, cardiovascular, meniscus, etc.) exploits the power of materials and bioactive molecules to guide stem cell behavior and construct living tissues and organs for repair therapies. Within UGent, different state of the art tools are available which allow us to fabricate cell-loaded structures at different scales with outstanding high resolution. Additionally, we are actively involved in the development of novel organ-on-chip devices using 3D printing technologies with unique capabilities for future diagnostic potential.

Different setups and expertise are available for fabricating scaffolds and other constructs both in non-sterile and sterile conditions. Additionally, we offer a wide experience in fabricating cell loaded structures for tissue engineering and organ-on-chip applications.



Personalized pharmaceutics

Within UGent, we have a vast experience in material development. This includes the synthesis of novel polymers as well as modifying natural ones to meet the intended application requirements. Additionally, the screening of polymeric formulations for achieving unique material properties. Moreover, our deep understanding of 3D printing processes such as extrusion-based and Vat photopolymerization technologies, allowed us to develop materials that have optimum printing characteristics during processing. Such applications in the biomedical sector include drug delivery, wound healing, ... Throughout the years, our researchers have gained the skills and developed the right techniques to achieve optimum materials with exceptional properties.