In 2018 several forward-looking projects were established. The founding of the MedTech OneWorld initiative, in which the internationalization activities of the chair in teaching and research are bundled, was of particular significance. International R&D groups were set up in Singapore and Ethiopia. Another highlight was the successful spin-off of KUMOVIS GmbH, winner of the competition, ‘Münchener Businessplan Wettbewerb 2018’.

In 2018, the chair was again significantly involved in the design of the Master’s programme in Medical Technology and Engineering. In addition, the chair taught the basics of plastics technology in lectures, seminars and internships.

The focus of research & development in 2018 continued to be on medical plastics engineering technology. In addition to working on existing projects, five new projects were acquired in 2018.

IoT and Plastics
Coordinator: Dipl.-Ing. Valerie Werner

SmartMold: Integration of IoT Electronics in Plastic Parts
(Funding: Internal; Leader: Dipl.-Ing. Valerie Werner)
Within the thematic focus ‘Digitale Gesundheit und Medizin’ of the Zentrum Digitalisierung Bayern, the chair coordinates the Community of Practice ‘IoT & Werkstoffe’.
In 2018, the foundations were laid for the creation of a ZIM cooperative network with eight industrial and academic network partners, in which R&D projects for the realization of smart biomedical plastic products are to be carried out from 2019.
Medical Materials and Medical Implant Design

Plastics Engineering
Coordinator: Dipl.-Ing. Matthias Zeppenfeld

BioPolFol: Antimicrobial Plastics Based on Electrets
(Funding: BMWi; Leader: Markus Ahrens, M.Sc.)

Antimicrobial polymers can be used in order to prevent the transmission of germs via surfaces. This project focuses on the development of a permanently antimicrobial silicone elastomer as an overlay material for relevant contact surfaces in medical areas.

Studies show that around 11 million tons of food are disposed of as waste in Germany every year. The aim is therefore to extend the shelf life of food. Plastic packaging plays a major role in this, with bioplastics becoming the focus of interest. Through certain modifications a charge change on the plastic surface can be achieved, so that electrets are produced. Electrets are materials that can store oriented electrical dipoles or an excessive electrical charge for a certain period of time and can also exert an antimicrobial effect. The aim of the BioPolFol project is to develop electrets with antimicrobial properties on the basis of various bioplastics by means of surface treatment.

Agar plate with grown bacteria colonies to assess antimicrobial polymer compounds

Cell-based Medical Engineering
Coordinator: Dr. Markus Eblenkamp

Miniaturized flow chamber with optimized flow conditions for dynamic cultivation of living cells to be produced by additive manufacturing

Lab 4.0: Smart Bioreactors for Cell-based Therapies
(Funding: StMWi; Leader: Richard Schmid, M.Sc.)

Cell-based methods offer fascinating new therapeutic possibilities (‘healing with cells’). The goal of the project is the development of miniaturized, mobile, intelligent systems for the cultivation and transport of therapeutic biological samples. The highly function-integrated plastic systems will be equipped with a wide range of sensors and digital, cloud-enabled interfaces that allow continuous process control and online process monitoring over the entire cultivation time.

Surfaces in medical facilities are always considered to be contaminated by microbes. These surface pathogens often form biofilms in which microorganisms stabilize each other and thus make decontamination more difficult. The resulting contaminations are further spread through contact between the hands of hospital staff and surfaces which leads to hospital infections. Antimicrobial polymers can be used in order to prevent the transmission of germs via surfaces. This project focuses on the development of a permanently antimicrobial silicone elastomer as an overlay material for relevant contact surfaces in medical areas.
Medical Materials and Medical Implant Design

Additive Plastics Processing
Coordinator: Stefan Leonhardt, M.Sc.

filAMent: High Performance Filaments for Additive Manufacturing
(Funding: Internal; Leader: Fabian Jodeit, M.Sc.)

CONNECT: Minimally Invasive Implant for the Connection of Intestinal Ends (Anastomosis)
(Funding: DFG; Leader: Stefanie Ficht, M.Sc.)
Using additive manufacturing, a degradable implant is developed with which the intestinal ends, after partial intestinal resections, can be surgically connected in a minimally invasive procedure.

RapidNAM: Automated Production of Palatal Plates for the Treatment of Cleft Lip and Palate
(Funding: Zeidler-Forschungs-Stiftung, Leader: Franz Bauer, M.Sc.)
Using additive manufacturing and digital techniques, a system for generating individualized palatal plates for early childhood therapy of cleft lip palates was developed.

APROV RB: Development of a Realistic Surgical Phantom for Minimally Invasive Surgery
(Funding: Zeidler-Forschung-SStiftung; Leader: Sebastian Pammer, M.Sc.)

Using additive manufacturing, an abdominal phantom was developed which is characterized by a previously unattained reality of the intraoperative situation. It represents an excellent exercise model for surgeons, which can also be used to simulate patient-specific surgical conditions in preparation for surgery.
Medical Materials and Medical Implant Design

MedTech OneWorld
Coordinator: Fabian Jodeit, M.Sc.; Dr. Markus Eblenkamp

The MedTech OneWorld initiative was founded to bundle and strategically align the chair’s international projects. Special attention is paid to developing countries. The aim is to implement high-tech medical engineering solutions in emerging regions. In Singapore and Addis Ababa (Ethiopia) the basis for joint research labs was laid. Furthermore, the student research group ‘MedTech OneWorld Students’ has developed from this commitment and currently has around 30 active members.

Events

Symposium on Medical Plastics Engineering, Singapore

On 16 July 2018, this year’s congress of the Zukunftsrat der Bayerischen Wirtschaft on the topic of ‘health and medicine’ took place. The chair presented its teaching and research activities in the field of additive manufacturing, cell-based medical engineering and the internationalization initiative MedTech OneWorld.

As an initiator, the chair, in cooperation with TUM Asia, NUS and NAMIC (National Additive Manufacturing Innovation Center), organized the networking seminar ‘New Frontiers in Biomedical Additive Manufacturing’ in Singapore on 6 February 2018. It was possible to bring together a cross-section of the Singaporean and German players in additive manufacturing (academic institutions, AM companies, clusters and funding organizations) and thus lay the foundations for joint international R&D projects to be implemented in 2019.

Congress Zukunftsrat der Bayerischen Wirtschaft, Munich

New Frontiers in Biomedical Additive Manufacturing, Singapore

As an initiator, the chair, in cooperation with TUM Asia, NUS and NAMIC (National Additive Manufacturing Innovation Center), organized the networking seminar ‘New Frontiers in Biomedical Additive Manufacturing’ in Singapore.
Entrepreneurship – From Bench to Market and Bedside

**KUMOVIS GmbH**
This spin-off of the chair (Miriam Haerst, Stefan Leonhardt, Alexander Henhammer, Sebastian Pammer and Stefan Fischer) has won the competition, ‘Münchner Businessplan Wettbewerb 2018’. KUMOVIS is developing a printer technology for processing high-performance polymers such as PEEK for medical applications. The team and the first concepts emerged from a project seminar of our chair. In 2018 the developments and the business concept were driven forward in the context of a successfully acquired EXIST transfer of research grant.

**IMPACT Platform for Autologous Cell Therapies**
The use of blood derivatives, e.g. platelet-rich plasma (PRP), to support the healing processes of injuries and surgical interventions is becoming increasingly important. Based on the developments of previous years, it was possible to bring a system for the fully automatic production of PRP and other autologous cell therapy derivatives to market maturity in 2018 via Plasmaconcept AG with the support of our chair.

**inveox GmbH**
Within the framework of an EXIST company founder grant and development cooperation, the chair supported the further development of inveox. The aim of its technology is to automate pathological processes in order to increase the efficiency of the processes and, in particular, to make them safer and the diagnoses more reliable for the benefit of patients.

**Vocational Training**
In 2018, the chair under the direction of Mr. Uli Ebner continued its intensive commitment to vocational training. Currently, six apprentices are being trained in precision mechanics.
Medical Materials and Medical Implant Design

Research Focus
- Medical materials
- Polymer technology
- Machine and process technology
- Cell-based medical engineering
- Implantology

Competence
- Polymer processing
- Additive manufacturing
- Materials testing, incl. biocompatibility
- Bioreactor designing
- Blood processing

Infrastructure
- Technical lab (CNC milling machine, water jet cutting, etc.)
- Bio lab (biocompatibility and sterility testing)
- Polymer lab (injection molding, extrusion, compounding, testing)
- 3D lab (DLP, FLM, multijet printing)
- Electronic lab (anechoic chamber, micrograph analysis, etc.)

Courses
- Introduction in Medical and Polymer Technology
- Biocompatible Materials
- Plastics and Plastic Processing
- Trends in Medical Engineering
- Vascular Systems

Selected Publications 2018
- Düregger, Katharina; Trik, Sina; Leonhardt, Stefan; Eblenkamp, Markus: Additive-manufactured microporous polymer membranes for biomedical in vitro applications. Journal of Biomaterials Applications 33 (1), 2018, 116-126
- Grill, Florian D; Ritschl, Lucas M; Dikel, Hannes; Rau, Andrea; Roth, Maximilian; Eblenkamp, Markus; Wolff, Klaus-Dietrich; Loeffelbein, Denys J; Bauer, Franz X: Facilitating CAD/CAM nasoalveolar molding therapy with a novel click-in system for nasal stents ensuring a quick and user-friendly chairside nasal stent exchange. Scientific Reports 8 (1), 2018