PRESS RELEASE

Biotechnology and Production Engineering – Enabler of Sustainable Value Creation

Sustainable value creation, which does not require limitations and conserves scarce resources of our planet, is likely the most urgent task of the 21st century. On the path to a circular economy, step-by-step optimizations will still be necessary. However, without groundbreaking innovations, the pace would be inadequate. Biomanufacturing, a still young discipline that integrates knowledge and methods from production engineering, biotechnology, and biology, is a promising approach: for example, it combines biotechnological processes with the capabilities of Industry 4.0 to substitute fossil materials and produce them in large quantities.

From June 11th to 13th, 2024, in Dresden, the Fraunhofer IWU will be hosting CIRP BioM, the most significant international conference for biomanufacturing and related fields. Leading international experts from science and industry will present the latest research findings and advances in biomanufacturing in Dresden together with researchers from IWU. Various topics at the interface between production engineering and biotechnology are on the agenda, among others, for example, the handling of human tissue, which is why the adjacent field of medical technology is also intensively discussed at the conference, thus placing humans at the center of biobased production.

Keynote speakers include Prof. Fengzhou Fang (Tianjin University/China), President of the International Academy for Production Engineering CIRP 2023-2024, and Dr.-Ing. Masahiko Mori, President of the machine tool manufacturer DMG MORI COMPANY LIMITED. The conference thus offers an outstanding platform for exchange among experts from science and industry and is also an ideal entry point for those interested in biomanufacturing. Below are some examples of the conference's key topics.

Bio-based Cutting Fluids: Powerful Alternatives

Metal cutting processes are associated with high thermomechanical loads and require cooling and lubrication solutions to minimize friction between the tool and the workpiece. When mineral oil-based cutting fluids are used, they significantly contribute to the CO2 footprint of production. A study by the Fraunhofer IWU confirms the suitability of water-miscible emulsions based on plant oils for milling operations on steels for aircraft construction. It considers the friction conditions in the contact zone between the tool edge and the workpiece, process forces, and resulting tool wear as

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technical performance indicators of the cutting fluids during machining. As a result, the study demonstrates the great potential of bio-based cutting fluids as powerful alternatives to conventional cutting fluids.

Innovative Tissue Engineering for Medical Treatments and Assessing the Effect of Medications on the Human Body

Forward-looking publications highlighted at the conference demonstrate the potential of tissue engineering and in vitro models for effective medical treatments and investigating drug effects on the human body. A study presented at BioM underlines the potential of tissue-engineered bypasses for the treatment of diseases affecting the heart and blood vessels. The focus is on the compatibility and effectiveness of the bypasses. Another publication deals with the importance of in vitro liver models in early drug development, aiming to better estimate the harmful effects medications may have and to correct the composition of preparations early on.

Composite Materials Based on Fungal Mycelium: Promising Material Class

Products like vegan leather already show that abstaining from animal-derived products and petroleum-based plastics is indeed possible. However, transitioning to engineering materials requires that growth and production processes must be reproducible within demanding quality requirements. Depending on the composition of the substrate, type of fungus, and growth conditions, various properties of the final product can be deliberately adjusted during growth. Cyber-physical (digitized) production systems have the potential to meet these quality requirements by compensating for, for example, quality fluctuations in the raw material and potential disturbances in production processes. Fungal mycelium-based materials and their production are becoming a new research focus at Fraunhofer IWU.

Abb. 1 Bio-based cutting fluids (such as those derived from sunflower oil, rapeseed oil, castor oil, or jatropha oil) are a powerful alternative to mineral oil-based cutting fluids
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Abb. 2 Depending on the composition of the substrate, type of fungus, and growth conditions, various properties of fungal mycelium-based materials can be deliberately adjusted during cultivation, such as hard and solid structures
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"Future Production. Driven by Nature" is the motto of BioM. Approximately 60 presentations by renowned experts from both academia and industry showcase the latest trends in the dynamic field of Biomanufacturing

The **Fraunhofer Institute for Machine Tools and Forming Technology IWU** is a driver for innovations in the research and development of production engineering. Around 670 highly qualified employees work at our locations in Chemnitz, Dresden, Leipzig, Wolfsburg, and Zittau. We open up the potential for competitive manufacturing in automotive and mechanical engineering, aerospace technology, medical engineering, electrical engineering, and precision and microengineering. We focus on scientific developments and contract research regarding components, processes, methods, and the associated complex machine systems and their interaction with humans – the entire factory. As the leading institute for resource-efficient manufacturing, we bank on highly flexible, scalable cognitive production systems using nature as an example. We consider the entire process chain using regenerative systems and circular economy in this context. We develop technologies and intelligent production plants and optimize forming, cutting, and joining manufacturing steps. Our range of services includes the development of innovative lightweight structures and technologies for processing new materials, functional transfer to assembly groups, and the latest technologies of additive manufacturing (3D printing). We present approaches for large-scale production of essential hydrogen systems, thus contributing to the transition to renewable energies.