

PRESS RELEASE

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International Conference on Programmable Materials - Hybrid Event on July 12-14, 2022

Global challenges such as climate change, renewable energy and individual mobility increase the necessity for a more efficient and sustainable use of our resources. Programmable materials have the potential to initiate a paradigm shift in the design and use of materials by replacing technical systems of many components and materials with a single, locally configured one. The first international conference on programmable materials aims to facilitate this paradigm shift for materials science. It creates the interdisciplinary scientific platform to accelerate the development, production and application of programmable materials. For more info, registration and for detailed program information visit www.progmatcon.com.

Programmable materials have the potential to initiate a paradigm shift since they can perform system functions through their internal design. This allows for increased functional integration while simultaneously reducing system complexity. Programmable materials are materials whose inner structure is designed and manufactured in such a way that properties and behavior can be controlled and reversibly changed. Furthermore, locally varying functions can be programmed into such materials.

Fully functional programmable materials require a combination of smart materials, mechanical and optical meta-materials and the ability to manufacture architected materials through e.g. additive manufacturing and/or sheet metal forming. Last but not least a highly interactive, interdisciplinary application design route is necessary to exploit the full potential.

Areas of Application

This opens up possibilities for novel application solutions where essential parts of system functionality are provided by the material itself. The programming ability stems from built-in logical elements and materials as well as the ability to process functions. The material response can either be triggered externally or the materials can automatically adapt to changing conditions in a predetermined manner.

The application potential for programmable materials is immense: programmable pore sizes enable self-cleaning membrane filters for water treatment systems, materials with programmable heat transfer ensure energy-efficient heat management in machines or buildings, shape morphing materials can change aerodynamics and programmable friction can be used to intelligently control coupling and positioning systems.

Editorial notes

Julia Dannehl | Phone +49 761 5142- 561 | julia.dannehl@iwmm.fraunhofer.de | www.iwmm.fraunhofer.de

FRAUNHOFER INSTITUTE FOR MECHANICS OF MATERIALS IWM**Program overview**

The three days include top-class plenary talks, five symposia, online poster presentations and panel discussions.

Symposia:

- Mechanical Metamaterials & Structural and Functional Optimization
- Polymers with Sequence Control
- Shape Memory Polymers & Programmable Property Profiles
- Design Ideas from nature
- livMatS symposium on energy harvesting, storage and conversion for programmable Materials

Overview plenary talks:

- “Bioinspired design of irregular architected materials with programmable properties” by Chiara Daraio (California Institute of Technology, USA)
- “Engineered Materials with bioprogrammable functions” by Aránzazu Del Campo (INM-Leibniz Institute for New Materials, Germany)
- “Developing animate materials using a linkage fabric approach” by Mark Miodownik (University College London, UK)
- “Pathways and Computing in Metamaterials” by Martin van Hecke (AMOLF Amsterdam & Leiden University, NL)

Target Audience

The conference is aimed at scientists and engineers who want to advance programmable materials with multidisciplinary contributions, who want to work on powerful tools for their realization, and who want to contribute to the paradigm shift in materials development.

Thematic priorities can be the simulation of programmed materials, the optimization and programming of material functions, the development of suitable process technology for modular or hybrid production of programmable materials or the validation of programmable materials by demonstrators and prototypes.

With its mix of presented and submitted lectures, poster sessions and workshops, the conference offers interdisciplinary researchers and developers an ideal forum for networking and exchange regarding all relevant aspects of programmable materials.

Program [Hyperlink: <https://www.progmatcon.com/en/program.html>]

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Registration [Hyperlink:

<https://www.progmatcon.com/en/participation/registration.html>]

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Understanding the potential of programmable materials. © Fraunhofer IWM, graphics: Gebhard|Uhl, Freiburg

Infobox: Fraunhofer Cluster of Excellence Programmable Materials CPM

The Cluster of Excellence Programmable Materials CPM merges the competencies of several Fraunhofer institutes. Together, they have a complete understanding of materials and materials-based processes, from the molecular to the macroscopic scale. The aim of the cluster is the programming of logic into materials for targeted modification of adaption, such as the shape, optical or mechanical properties. For more information please visit: <https://cpm.fraunhofer.de/en.html>.

Fraunhofer IWM – Making intelligent use of materials

- We make the mechanisms and processes in materials and material systems manageable by first assessing and describing them as models. This provides the potential to extract greater performance and efficiency from technical systems.
 - We measure materials down to their atomic structures and influence the interactions. This enables us to modify material properties to meet requirements and achieve new functionalities.
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FRAUNHOFER INSTITUTE FOR MECHANICS OF MATERIALS IWM

- We scrutinize material systems and manufacturing processes and this knowledge is transferred into reliable products and technologies. Together with our partners from the fields of science and business, we develop innovations with a competitive edge.

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The **Fraunhofer-Gesellschaft**, headquartered in Germany, is the world's leading applied research organization. Fraunhofer plays a central role in the innovation process. As a pioneer and catalyst for groundbreaking developments and scientific excellence, Fraunhofer helps shape society now and in the future. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research institutions throughout Germany. The majority of the organization's 29,000 employees are qualified scientists and engineers, who work with an annual research budget of 2.8 billion euros. Of this sum, 2.4 billion euros is generated through contract research.

Further Contacts

Wiebke Beckmann and **Isabelle Binninger** | Phone +49 761 5142-418 | geschaeftsstelle@cpm.fraunhofer.de
Fraunhofer Institute for Mechanics of Materials IWM | www.iwm.fraunhofer.de/en