

FOSTERING THE PARADIGM SHIFT IN MATERIALS RESEARCH

International Conference on Programmable Materials

27 - 29 April 2020, Berlin

Symposium

Design ideas from nature

The future of massively digital industrial applications will require materials that are no longer passive components of active devices, but become themselves operational as carriers of information. Indeed, information stored in smart materials that are responsive and even adaptive does not need to be centrally processed which is both time and energy consuming. This is analogous to natural systems where every activity is distributed over many length scales, from molecule to tissue, organ and the whole organism, and where information is processed both in the periphery and centrally in the brain. This, however, requires materials that can be prepared so that they react in a predefined way to a stimulus from the environment, so that tasks can be subdivided in a hierarchical way into repetitive operations that are directly carried out by programmable materials and a coordinating function that is typically provided by digital control.

Since natural systems have perfected this way of functioning through millions of years of evolution, they can provide conceptual visions for the development of programmable materials suitable to be employed in this manner. For example pine cones open and close upon humidity changes, but some species also are designed such that they only eject their semen when a certain sequence of events takes place, such as high temperatures (fire) followed by high humidity (rain). Moreover, bone cannot only repair structural defects very effectively, the material also adapts to varying loading conditions. All these actions are taken by the material without central data processing, i.e. the material itself is sensor and actuator.

In order to impart these functions onto artificial materials, interdisciplinary research between biology, physics and chemistry is required. Therefore, the symposium shall be an interdisciplinary discussion platform showcasing exemplary materials from nature, aiming to elucidate the design principles and

foster the detailed understanding of their programmed functions. Once understood, these concepts shall be transferred to purely synthetic materials enabling them to mimic the natural examples. Such materials will open new perspectives in material design both with respect to structure as well as function.

We aim at bringing together biologists, physicists and chemists from an international research community to provide an overview of current research in the fields of structure and function of natural materials as well as bio-inspired materials. Experimental, synthetic and theoretical works are welcome. Abstracts for lectures and posters can be submitted and will be evaluated by the scientific committee.

Summary:

The symposium will focus on various design principles from nature, inspiring the integration of sensing and actuating functionalities into modern artificial materials.

Symposium organizers

*Prof. Dr. Alexander Böker, Fraunhofer IAP, Potsdam,
alexander.boeker@iap.fraunhofer.de;*

Prof. Dr. Dr.h.c. Peter Fratzl, MPI für Kolloid- und Grenzflächenforschung, Potsdam, gabbe@mpikg.mpg.de