Fraunhofer CPM

FOSTERING THE PARADIGM SHIFT IN MATERIALS RESEARCH

International Conference on Programmable Materials

27 - 29 April 2020, Berlin

Symposium

Manufacturing and upscaling

Intentional changes of material properties or shapes of components in technical applications have the potential to widely revolutionize industrial products and production techniques. For instances programmable stiffness and situational shape shifting can be expected to be very large in market volume. Materials with programmable stiffness have possible applications in inherently safe robot structures for human-machine cooperation or in the bumper area of vehicles. Another big field of application is active aerodynamics, in which all kinds of road and rail vehicles, ships and planes, pumps or wind turbines can minimize or maximize their aerodynamic drag by altering their shapes depending on the operating conditions.

The transfer of mostly nano- and micro-scale approaches to the programming of materials on the component level requires a production engineering that allows efficient production of functionally integrated materials. In this respect, new production methods making use of self-organization, the development of Claytronics and even the integration of smart dust attempts are possible innovative concepts. It is expected that not only one property will be programmable in future assemblies and systems, but that the components and modules will generally require locally different functionality. Therefore, the technological approaches to material and part production must be flexible enough to manufacture components with locally different functional elements.

Today, the construction of complex macroscopic components made entirely of micro-scale programmable structures does not seem to be feasible from an economic point of view, but concepts that cleverly integrate various programmable function blocks into structural components can be a solution:

- For components with high structural requirements, programmable function modules can be integrated using, for example, additive manufacturing techniques.
- In the case of large quantities, partially semi-finished products could be used in order to keep the process chains as short and efficient as possible, which means that multifunctional semi-finished products are necessary whose functions are programmed also during the manufacturing step of the component and not entirely during the production of the material. This can be both, the adaptation of the functional properties of a material e.g. actuator or sensor function in Shape Memory Alloys, as well as the local introduction of certain functionalizations.

The aim of this symposium is to give an overview of current scientific work in the field of scaling of mechanical metamaterials, for which solutions for different production technologies are presented and discussed. In addition, results from basic research and application-oriented development are presented. Both experimental and simulative work as well as methods for structure and topology optimization are considered.

Symposium organizers
Dr. Bernd Bader, Fraunhofer ICT, Pfintztal,
bernd.bader@ict.fraunhofer.de;
André Bucht, Fraunhofer IWU, Dresden,
andre.bucht@iwu.fraunhofer.de

2019-7-1 | f_1904_166-6