



NEWSLETTER

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Cover Photo: Wuhan University, China (the Venue of ICBE 2022)

After 10 years of successful ISO standardization of biomimetics within DIN Germany the committee management will be transferred to SAC China

Heike Beismann (Germany, Westfälische Hochschule), Olaf Rehme (Germany, Siemens AG), Michael Schmitt (Germany, DIN), Roman Rüttinger (Germany, DIN)

At the end of the year 2021 the secretariat of the Technical Committee Biomimetics at ISO (International Standardization Organisation, ISO/TC 266 "Biomimetics") will be transferred from DIN (Deutsches Institut für Normung, Germany) to SAC (Standardisation Administration of China, China). On this occasion, we look back on the previous 10 years of activities that have led to the publication of three basic standards in the field of biomimetics (ISO 18459, ISO 18457 and ISO 18458).

Starting point

The starting point of the international activities was a set of German VDI Guidelines (VDI 6220 to VDI 6226, VDI: Verein Deutscher Ingenieure, Association of German Engineers) dealing with biomimetics. Three bilingual guidelines were selected to serve as a basis for the preparation of international standards within the framework of the project ISOBIONIK, funded by the German Federal Ministry of Economics and Technology.

Establishment of standardization bodies

The first step towards transferring the VDI Guidelines to the international standardization level was the establishment of the Working Committee NA 062-08-60 AA "Bionik" in the DIN Standards Committee for Materials Testing (NMP). The constituent meeting of this working committee took place on 13.9.2011 in Berlin. With Dr. Olaf Rehme from Siemens AG an industry representative could be won for the office of chairman. The working committee now concentrated on the establishment of the International Technical Committee ISO/TC

266 "Biomimetics", which was concluded on 9/10 October 2012 with the founding meeting in Berlin. Dr. Olaf Rehme also assumed the chairmanship of this committee.

Three working groups could be founded, each dedicated to one of the standardization projects. ISO 18458 deals with biomimetic terminology and methodology, ISO 18457 with structures and materials and ISO 18459 with biomimetic optimization.

Terminology: ISO 18458

ISO 18458 (chaired by Prof. Dr. Heike Beismann, Germany, Westfälische Hochschule) deals with the question of what biomimetics is and when a product or process is "biomimetic". Internationally "biomimetics" is now defined as "interdisciplinary cooperation of biology and technology or other fields of innovation with the goal of solving practical problems through the function analysis of biological systems, their abstraction into models, and the transfer into and application of these models to the solution". There is also a differentiation from terms that are often used synonymously with biomimetics, but convey different contents. For example, the term biomimicry or bionics.

The definition of when a product is biomimetic can be understood as the central point of the standard. The decision whether a product or a technology can be regarded as biomimetic can be made on the basis of three criteria (steps). According to ISO 18458, a product can only be classified as biomimetic if it follows the following three steps of the biomimetic process:

- a functional analysis of an available biological system was performed;

- the biological system has been abstracted into a model;
- the model has been transferred and applied to design the product.

This definition is clarified in the standard by means of several examples.

Optimization: ISO 18459

ISO 18459 (chaired by Dr. Iwiza Tesari, Germany, Karlsruhe Institute of Technology) describes the functions and applications of biomimetic structural optimization methods. For example, the process of building up and decomposing bone substance can be used as a biological model for topology optimization. Thus lightweight components are designed for the development of vehicle frames by removing underloaded material using the soft-kill option method (see Figure 1).

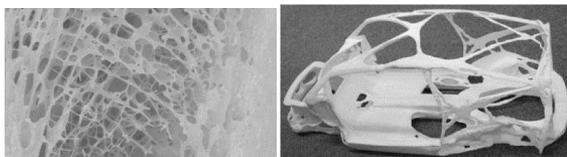


Figure 1 - Topology optimization for designing lightweight components by removing underloaded material (Source: ISO 18459:2015)

The standard describes in detail computer-aided optimization techniques based on the biological model of natural growth and FEM optimization techniques for technical components such as Computer Aided Optimization (CAO), Soft Kill Option (SKO) and Computer Aided Internal Optimization (CAIO). In addition, a simpler and faster "Method of Tensile Triangles" is described that can be used by any designer.

Materials: ISO 18457

ISO 18457 (chaired by Stephan Hoornaert, Belgium) deals with biomimetics in relation to the development of materials, structures, surfaces, components and manufacturing technologies. For example, the Morpho butterfly (see Figure 2) creates the bright blue appearance of its wings through a structural colouring. Its wing scales have a lamellar structure that

produces optical interference effects. The lamella structure of the wing scales could serve as a biological model for the colouring of biomimetic tissues. From the abstraction of the mechanism of structural colours, optical interference colours can be created by stacking two polymers with different refractive indices.



Figure 2 - Morpho butterfly and lamellate structure of the wing scales (source: ISO 18457:2016)

Further Activities

The standards described above form the core of the activities of ISO/TC 266. Another activity is a Japanese initiative, which is being worked on in the Japan-led ISO/TC 266/WG 4 "Knowledge infrastructure of biomimetics" working group. Under the ISO/TR 18887 series of standards, a three-part technical report is in preparation which has set itself the task of providing technical aids with the help of which a person concerned with an engineering problem can come across key words that lead to biological models for problem solving.

Apart from this initiative, ISO/TC 266 is currently in a phase of developing a strategy for future activities. This is therefore an excellent time for newcomers to implement their own ideas. The handover of the committee management and the chairmanship to China opens up the opportunity to give new impetus at exactly the right time and to push ISO/TC 266 into new directions.

The last international meeting of the Technical Committee "Biomimetics" led by Germany took place online on 8 to 10 September 2021. DIN Germany welcomes as new committee manager Xiugong Qin and is pleased to welcome Prof. Dr. Zhihui Zhang (China, Jilin University) as its new Chairman.

Newsletter

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