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Organisation internationale de normalisation
International Organization for Standardization
Международная Организация по Стандартизации

TO THE ISO MEMBER BODIES

Our ref. TS/P 222

Date 2011-05-20

ISO/TS/P 222 *Biomimetics*

Dear Sir or Madam,

Please find attached a proposal for a new field of technical activity on *Biomimetics* submitted by DIN (Germany).

According to subclause 1.5.6 of Part 1 of the ISO/IEC Directives, you are kindly invited to complete the ballot form (Form 02) which can be downloaded at www.iso.org/forms and send it (preferably in Word format) to the Secretariat of the ISO Technical Management Board at *tmb@iso.org* before **20 August 2011.**

Yours faithfully,

Michael A. Smith
Secretary of the Technical Management Board

Encl:
TS/P 222

PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY	
Date of proposal 2011-05-16	Reference number (to be given by Central Secretariat)
Proposer DIN-Germany	**ISO/TS/P 222**

A proposal for a new field of technical activity shall be submitted to the Central Secretariat, which will assign it a reference number and process the proposal in accordance with the ISO/IEC Directives (part 1, subclause 1.5). The proposer may be a member body of ISO, a technical committee or subcommittee, the Technical Management Board or a General Assembly committee, the Secretary-General, a body responsible for managing a certification system operating under the auspices of ISO, or another international organization with national body membership. Guidelines for proposing and justifying a new field of technical activity are given in the ISO/IEC Directives (part 1, annex Q).

The proposal (to be completed by the proposer)

Subject (the subject shall be described unambiguously and as concisely as possible)

Biomimetics

Scope (the scope shall define precisely the limits of the proposed new field of activity and shall begin with "Standardization of ..." or "Standardization in the field of ...")

Standardization in the field of biomimetics. The proposed ISO/TC will be responsible for the international standardization of biomimetic methods and approaches, incorporating the most recent results of R&D projects.

"Biomimetics" (also "bionics", "biomimicry") is to be classified and defined, and a terminology developed. The limits and potentials of biomimetics as an innovation system or a sustainability strategy are to be explored.

The entire biomimetic process ranging from the development of ideas to the creation of bionic products is to be described and standardized.

Purpose and justification (the justification shall endeavour to assess the economic and social advantages which would result from the adoption of International Standards in the proposed new field)

Bio-inspired materials and design are becoming of increasing interest in many fields of practical applications. In contrast to man-made materials, natural materials such as wood, bone and shells are composed of only a limited number of basic components. They gain their diversity in mechanical properties by hierarchical structuring which allows them to fulfill a variety of functions e.g. self-healing, mechanical stability, high toughness.

As a result of quickly advancing physical characterization techniques, knowledge about hierarchical structures has increased significantly in recent years and form-function relationships are being unveiled. But combining the knowledge of natural materials with modern techniques of simulation and fabrication is still the exception, also due to the lack of communication between bio- and material scientists.

The proposed standardization activities will make interdisciplinary work possible. The aim is the efficient translation of research results into technical products along the entire value chain through the close cooperation of biologists, engineers and experts from other disciplines. The realization of bionic ideas relies on the successful abstraction of biological principles and the transfer into technology. The successful transfer of knowledge about the structures, processes and characteristics of living beings to technical systems requires clear communication, correspondence and transparency between disciplines . Standards can make a major contribution to laying these foundations. By standardizing terms and definitions on a global level a common language will be established. International cooperation common in biomimetic projects will therefore be greatly simplified.

So far Biomimetics has not been standardized on International level (ISO) and/or on European level (CEN). This is partly due to the fact that Biomimetics are interdisciplinary.

See overleaf

Purpose and justification (continued)

Because of this versatility it is barely possible to focus Standardization activities only on one already existing ISO/TC of numerous possible ISO/TC's. And even if Biomimetics would be standardized in one of the existing ISO/TC's the scope of this certain ISO/TC would only cover a part of it.

This exposes the intension of the proposer to establish a new ISO/TC "Biomimetics".

The main motivation for transferring biological solutions to technical applications lies in the fact that optimized biological structures which have evolved over a period of 3,8 billion years can also be significant for technological developments. Today over 2,5 million distinct species have been identified, a gigantic pool of ideas for applying bionics to technical solutions.

There are various examples of ideas that can be used as basic approach for standardization efforts.

A method for developing surface structures for reducing frictional resistance in connection with methods for developing self-cleaning surface structures, e.g. for the hulls of ships and aircraft, could be covered. There are over 200 patents dealing with the "Lotus-Effect®" and numerous practical applications include self-cleaning exterior paints, plasters, and roof tiles. In plastics moulding processes the effect is used for injection moulding parts with self-cleaning surfaces.

Another example are biomimetic methods considering cutting tools. To ensure that conventional cutting tools remain constantly sharp, material wear must be minimized. However, teeth of rodents remain sharp through a constant self-sharpening process by wearing of two different materials which results in a sharp edge. This principle was used to develop self-sharpening cutting tools.

Biological models for lightweight construction and other structures include winter horsetail (Equisetum hyemale) and the giant reed (Arundo donax). A recently developed material combines the various principles of the winter horsetail and giant reed: This "technical blade of grass", a bionic fibre-based composite material, is characterized by a high level of bending stiffness, and an extremely high dynamic load capacity and damping behaviour. This new type of material can be used for many applications, including aerospace technology, vehicle construction, building and civil engineering, machinery and equipment construction, medical technology (prosthetics) and sports equipment.

Design approaches which make bionic knowledge available for lightweight construction have great potential. Computer simulations such as the CAO (computer aided optimization) and SKO (soft kill option) methods are already being used during the design process to optimize parts depending on the loading to which they will be subjected, which results in considerable material savings, as well as unconventional designs. Other methods of optimization, such as evolutionary algorithms, can also be dealt with.

Another area of bionic information processing includes active tactile sensors abstracted from insects Contactless distance measurement quickly reaches its limits in the field, because infrared sensors are affected by the sun, reflective and transparent surfaces cause camera systems to misread, echoes and thin structures throw off ultrasound measurements. Mechanical measurement systems, on the other hand, are much more precise, reading the physical information a robot truly needs for the next step.

In terms of practical application, it is increasingly important that the description, specification and standardization of bionic approaches are used to establish a proposal for "best practice".

Purpose and justification (continued)

The standards are important for various fields where benefits are to be gained.

The environment:

Biomimetic products can be potentially more sustainable and more environmentally compatible than conventional ones. However, this depends on transfer and used material, therefore biomimetic products are not "per se" more environmentally friendly than conventional ones.

Businesses:

Standardization will give businesses tools for developing bionic strategies for new products, resulting in an expanded product development portfolio and new products for the market. Standards as language of technology are understood and accepted in countless branches of industry. The procedures described can be used as objective benchmark and its reproducibility is demonstrated. Outlining results in standards strengthens confidence in the quality of the research, therefore making it easier to close the gap between research and commercialization efforts. The development of biomimetic ISO-standards makes it easier to establish references between basic design standards in certain fields and suitable biomimetic processes. Standards also play an important role for the efficient fulfilment of due diligence requirements businesses have to exercise.

Customers:

Through standardization customers can be sure that products advertised as bionic are indeed such. In legal proceedings, it will be possible to establish when a product or parts thereof can be deemed "bionic" and when not.

Summary:

The identification of suitable biological principles and implementing them in bionic technical applications would be a major contribution towards developing functional adaptive, resource-efficient materials, structures and components that are safe for humans and the environment. Standardization in this area plays an important part towards disseminating bionic principles for energy-efficient, sustainable technical development while conserving resources.

Programme of work (list of principal questions which the proposer wishes to be included within the limits given in the proposed scope, indicating what aspects of the subject should be dealt with, e.g. terminology, test methods, dimensions and tolerances, performance requirements, technical specifications, etc.) It is also possible to attach a detailed programme of work showing proposed work item titles.

List of standards required	Priority	Working Group No
1 Definition biomimetics – Differentiation between bionic and conventional methods / products	1	WG 1
2 Functional bionic surfaces – Surface structures for self-cleaning and reducing fouling	1	WG 2
3 Bionic tools	3	WG 2
4 Bionic materials, structures and components	1	WG 2
5 Bionic optimization – Evolutionary algorithms	2	WG 3
6 Bionic optimization – Application of biological growth laws for the optimization of technical structures	2	WG 3
7 Bionic information processing	1	WG 3
NOTE This list should be reviewed and supplemented as needed in due course.		

To ensure efficient work we recommend to set up three WGs.

WG 1: Concept and strategy

This WG should primarily deal with the differentiation between bionic and conventional processes. The standard developed should be general in nature.

A definition has already been drawn up at German national level; this can serve as the basis for an international standard on the general concept and strategy of biomimetics, laying down terminology, including definitions. Such a general standard would thus contribute considerably to the quality assurance of bionic products.

WG2: Structures and materials

This WG should develop standards on functional bionic surfaces, tools, structures and materials.

One standard could specify the method for developing surface structures for reducing frictional resistance and methods for developing self cleaning surface structures.

Another standard deals with methods for developing self-sharpening cutting tools and bionic aspects of further tools.

Yet another standard covers lightweight construction and other structures.

Programme of work (continued)

WG3: Bionic optimization and information processing

This WG will develop standards on bionic optimization, evolutionary algorithms and bionic information processing.

One standard could deal with design approaches which make bionic knowledge available for lightweight construction.

Another standard will deal with on bionic information systems, including a modem based on S2C technology for use in a Tsunami warning system.

Yet another area to be covered in a standard is information processing including active tactile sensors modeled on insects.

Survey of similar work undertaken in other bodies (relevant documents to be considered: national standards or other normative documents)

Germany:

The German Institute for Standardization (DIN) is currently carrying out a research project on quantifying self-cleaning characteristics and preparing suitable measurement methods for standardization (http://www.ins.din.de/).

The Association of German Engineers is currently developing a number of different VDI Guidelines for different bionic fields. Two of them are already published, the rest of them (except VDI 6226) will be published in 2011.

VDI 6220 (2011-06 draft)	Biomimetics – Conception and strategy - Differences between bionic and conventional methods and products
VDI 6221 (2011-07 draft)	Biomimetics – Functional bionic surfaces
VDI 6222 in development	Biomimetics – Bionic robots
VDI 6223 in development	Biomimetics – Bionic materials, structures and components
VDI 6224 Blatt 1 (2011-06 draft)	Biomimetic optimization – Application of evolutionary algorithms
VDI 6224 Blatt 2 November 2010	Bionic optimization - Application of biological growth laws to the structure-mechanical optimization of technical components
VDI 6225 November 2010	Biomimetics – Bionic information processing
VDI 6226 in development	Biomimetics – Architecture, construction engineering, industrial design

Liaison organizations (list of organizations or external or internal bodies with which cooperation and liaison should be established)

A strong liaison should be established with Biokon international- The biomimetics association. BIOKON international provides a forum for information, discussion and collaboration for its members and the scientific community, acting together in European and global projects of international frameworks, organizations and institutions.

As biomimetics can be used in many fields of practical applications, a cooperation should be established with numerous already established ISO/TCs. Regarding the described programme of work, the following ISO/TCs should be considered.

ISO/JTC 1 "Information technology"

ISO/TC 37 "Terminology and other language and content resources"

ISO/TC 39 "Machine tools"

ISO/TC 98 "Bases for design of structures"

ISO/TC 107 "Metallic and other inorganic coatings"

ISO/TC 184 "Industrial automation systems and integration"

Other comments (if any)

The German National Standards Institution (DIN) is prepared to undertake the secretariat duties of the proposed committee.

Signature of the proposer

Dr.-Ing. Ulrike Bohnsack

Director Standardization

Comments of the Secretary-General (to be completed by the Central Secretariat)

Signature **Michael A. Smith**

Secretary of the TMB