ICS 07.080
CCS A 40

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 47244-2026

Heterogeneous biomimetic structures - Design, manufacture and optimization - Methodology

异质仿生结构 设计、制造与优化 方法论

Issued on: February 27, 2026 **Implemented on: September 1, 2026**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed by the China Machinery Industry Federation. This document is under the jurisdiction of the National Technical Committee on Standardization of Bionics (SAC/TC598). This document was drafted by: Jilin University, Beijing Institute of Mechanical Industry Automation Co., Ltd., Xi'an Jiaotong University, Liaocheng University, and Southern University. University of Science and Technology of China, Jiangsu University, China University of Petroleum (Beijing), China Energy Research Institute (Beijing), Qingdao University of Technology, Beijing Space Aircraft Overall Design Department, Liaoning Materials Laboratory, Xi'an University of Electronic Science and Technology, Jiangsu University of Science and Technology, and Qilu Second Hospital of Shandong University. The main drafters of this document are. Zhang Zhihui, Qin Xiugong, Li Suzhi, Zhang Qingquan, Huang Shilong, Sun Qun, Ge Qi, Lu Jinzhong, Hao Shijie, and Kong Dekun. Jiang Jiang, Guo Hui, Zhang Guangming, Zhang Xiaoyu, Xu Yichen, Luo Kaiyu, Pan Ke, Wang Ling, Yu Zhenglei, Wang Rong, Xu Gang, Zhang Baoyu, Kong Deyin, Yue Tailin Liu Zhongcheng.

With the rapid development of digital design and advanced manufacturing technologies, the concept of heterogeneous biomimetic structures and related technologies are increasingly being applied in social life and industry. Applications have been found in fields such as manufacturing and defense technology. Heterogeneous biomimetic structures mimic the efficient combination of different materials and functional units found in biological organisms. This design achieves multifunctional integration and performance optimization, possessing excellent properties such as lightweight and high strength, wear resistance and crack resistance, and energy absorption, representing a new generation of functional

materials. The development direction of materials and structural design. However, the inherent interdisciplinary nature of heterogeneous biomimetic structures makes their design, manufacturing, and optimization work challenging. Its high complexity presents numerous challenges for product development and industrial promotion. For example, the concept of heterogeneous biomimetic structures is not yet standardized. Its design still relies heavily on empirical modeling of specific components, and the manufacturing results vary considerably. These issues severely limit the development of heterogeneous materials. The future development and application of biomimetic structural technology. This document aims to provide guidance for the design, fabrication, and optimization of heterogeneous biomimetic structures. Its main purpose is to promote the design of heterogeneous biomimetic structures. The standardization of activities in the fields of design, manufacturing and optimization will promote the research and development and industrialization of heterogeneous biomimetic structure-related products. Heterogeneous biomimetic structure design, manufacturing and optimization Methodology

1 Scope

GB/T 47244-2026 is the Chinese national standard covering structures that copy nature's habit of grading one material into another - bone into cartilage, shell into membrane - and the design and manufacturing methods, mostly additive, that can actually produce such a gradient. First edition, in force since 1 September 2026, with the biomimetic surface friction standard GB/T 47232-2026. It was issued on 27 February 2026 and has been in force since 1 September 2026, as a first edition. The document is under the responsibility of the China Machinery Industry Federation. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document defines the concept and classification of heterogeneous biomimetic structures and describes general methods for their design, fabrication, and optimization. This document applies to the research, design, and manufacturing of heterogeneous biomimetic structural materials and components.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are not included. For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies. This document.

GB/T 42444-2023 Bionic Terminology, Concepts and Methodology

3 Terms and Definitions

The terms and definitions defined in GB/T 42444-2023, as well as the following terms and definitions, apply to this document.

3.1 In biomimetic structural materials or components, the smallest structural unit that can indicate its structural, morphological, and compositional characteristics.

3.2 Within a certain scale range, local regions of a material exhibit diverse physical properties, chemical composition, mechanical structure, and mechanical properties. The structure of attributes.

Note. Composite materials with a periodic distribution of reinforcing phases (such as fiber/particle reinforcement) belong to a special type of heterostructure.

3.3 By mimicking the heterogeneous distribution of biological structures in terms of morphology, mechanics, or materials, we can design and fabricate substances with certain superior functions or properties. Artificial structures.

3.4 Material optimization Guided by the target function, a systematic approach is adopted to match material properties with the requirements of biomimetic structures by adjusting material composition and microstructure. method.

Note. Material properties include, but are not limited to, specific indicators such as strength, stiffness, toughness, and corrosion resistance.

3.5 Based on the topological characteristics and load transfer laws of biological prototypes, parametric modeling, finite element simulation, topology optimization, or machine learning are used to calculate... Methods are the process of iteratively improving micro/meso/macro structural parameters such as geometric shape, structural distribution, and connection method.