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**Functionally graded additive manufacturing - Process
specification**

增材制造 功能梯度增材制造工艺规范

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1. Structure and drafting rules for standardization documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed by the China Machinery Industry Federation. This document is under the jurisdiction of the National Additive Manufacturing Standardization Technical Committee (SAC/TC562). This document was drafted by: Qingdao University of Technology, Shenzhen Collaborative Innovation High-Tech Development Co., Ltd., China National Petroleum Corporation Well Logging Co., Ltd., China Machinery Research Institute of Standards and Technology (Beijing) Co., Ltd., Northwestern Polytechnical University, Beijing Yuding Additive Manufacturing Research Institute Co., Ltd., Dalian University of Science and Technology, Shenyang Jinghe CNC Technology Development Co., Ltd., Beijing Wanwei Additive Technology Co., Ltd., Xi'an National Institute of Additive Manufacturing Co., Ltd., Shenzhen Jinshi 3D Printing Technology Co., Ltd., Ocean University of China, Sichuan Airlines Aircraft Engine Maintenance Engineering Co., Ltd. Beijing University of Science and Technology, Institute of Mechanics, Chinese Academy of Sciences, Shenyang Aircraft Design and Research Institute, Aviation Industry Corporation of China, South China University of Technology China Coal Beijing Coal Mining Machinery Co., Ltd., Guangdong Hanbang Laser Technology Co., Ltd., Taihang National Laboratory, Guangdong Yuehai Huajin Technology Co., Ltd., Xi'an Intelligent Remanufacturing Research Institute Co., Ltd., Wuxi Inspection, Testing and Certification Research Institute, Shanghai Liantai Technology Co., Ltd. Company, Changzhou Industrial Internet Research Institute Co., Ltd. The main drafters of this document are. Lan Hongbo, Zhang Guangming, Ma Xiao, Wang Yuxuan,

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1 Scope

China's national process specification for functionally graded additive manufacturing. Functional grading means varying the material continuously through a part rather than making it of one alloy, and additive manufacturing is the first process that can actually do it - depositing material point by point, it can change composition between one layer and the next. The applications are the ones where a joint would otherwise be the weak point: a transition from steel to a copper alloy in a rocket engine's chamber, from a structural alloy to a wear-resistant surface, from metal to ceramic in a thermal component. Instead of a bond between two dissimilar materials with its mismatch in expansion and its brittle intermetallics, there is a gradient. The difficulties are correspondingly real - some composition paths pass through brittle phases and must be routed around - and the standard specifies the classification, general requirements, common process flow, quality inspection and technical data delivery for such processes.

This document specifies the classification, general requirements, common process flow, quality inspection and technical data delivery of functionally graded additive manufacturing processes. This document applies to functionally graded additive manufacturing.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB 15577 Dust explosion safety regulations

GB/T 35022 Main characteristics and test methods of additive manufacturing parts and powder raw materials

GB/T 35351 Terminology for Additive Manufacturing

GB 50019 Design code for heating, ventilation and air conditioning of industrial buildings

3 Terms and definitions

The terms and definitions defined in GB/T 35351 and the following apply to this document.

3.1 In the additive manufacturing process, the microscopic elements (including material composition and/or structure) of the product are changed to form a continuous (or An additive manufacturing process that achieves continuous (or discontinuous) gradient changes in its performance and function.

3.2 By controlling two or more material components from one direction (one-dimensional, two-dimensional or three-dimensional) to another direction continuously or discontinuously A non-homogeneous material that changes so that the performance and function of the product change gradually.

3.3 By adjusting the material structure (microstructure or lattice structure) to change continuously or discontinuously in space, the performance and function of the product can be changed in a gradient manner. A heterogeneous structure.

Note. Typical microstructure or lattice structure functional gradient changes include variable density, variable stiffness, etc.

3.4 Single material functional gradient additive manufacturing single material FGAM Using a single material, functionally graded additive manufacturing can achieve integrated manufacturing of functionally graded structures and macro-geometry Craftsmanship.

3.5 Multi-material Functional Gradient Additive Manufacturing multi-material FGAM Use two or more materials to achieve integrated manufacturing of material composition gradient and macroscopic geometry using functional gradient additive manufacturing