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**Standard practices for evaluating the hydrothermal resistance
of carbon fibre reinforced polymer composites**

碳纤维增强复合材料耐湿热性能评价方法

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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 be subject to patents. The publisher of this document assumes no responsibility for identifying patents. This document is proposed by China Building Materials Federation. This document is under the jurisdiction of the National Technical Committee on Standardization of Fiber Reinforced Plastics (SAC/TC39). This document was drafted by: Harbin Institute of Technology, Sinopec Shanghai Petrochemical Co., Ltd., University of Science and Technology Beijing, MCC Construction General Research Institute Co., Ltd., Beijing FRP Institute Testing Center Co., Ltd., Yangtze River Delta Carbon Fiber and Composite Materials Technology Innovation Center, Tsinghua University, Zhejiang Sci-Tech University, Beijing Fiberglass Institute of Composite Materials Co., Ltd. The main drafters of this document. Xian Guijun, Huang Xiangyu, Yue Qingrui, Yang Yongxin, Yi Xiaosu, Xin Meiyin, Liu Xiaogang, Zhang Haiyan, Li Chenggao, Qi Xiao, Wang Bin, Pan Yunfeng, Han Feng, Feng Peng, Wang Anni, Guo Rui, Dong Shaoce, Kong Deao, Tian Jingwei, Wang Zhen, Zhang Puxuan, Li Biao, Wang Pengfei. Carbon fiber reinforced composite materials are resistant to moisture and heat Performance evaluation methods

1 Scope

China's national practices for evaluating the hydrothermal resistance of carbon fibre reinforced polymer composites. Hydrothermal ageing is the combination of moisture and heat, and it is the environmental attack that governs the design of composite structures. The fibre is unaffected; the polymer matrix absorbs water, which plasticises it and lowers its glass transition temperature, and the interface between fibre and matrix can be degraded outright. The consequence is that the properties dominated by the matrix - compression, shear, and anything at elevated temperature - fall substantially, while the tensile strength along the fibres barely changes. Aircraft design allowables are therefore established on

specimens conditioned to saturation and tested hot and wet, which is the worst case the structure will see. Standardising the conditioning is what makes those allowables comparable, since the absorption depends on the exposure and takes months to reach equilibrium.

This document specifies the test principles, test equipment, specimens, test conditions, and test methods for evaluating the moisture and heat resistance properties of carbon fiber reinforced composite materials. Test procedures, result calculations, evaluation and grading methods and test reports. This document is applicable to the evaluation of the heat and moisture resistance of carbon fiber reinforced resin matrix composites without external stress.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations For undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to this document.

GB/T 1034 Determination of water absorption of plastics

GB/T 1446 General principles for performance test methods of fiber reinforced plastics

GB/T 1447 Test method for tensile properties of fiber reinforced plastics

GB/T 1449 Test method for bending properties of fiber reinforced plastics

GB/T 2573-2008 Test method for aging properties of glass fiber reinforced plastics

GB/T 17657 Test methods for physical and chemical properties of artificial panels and decorative artificial panels

GB/T 30969 Test method for short beam shear strength of polymer matrix composites

GB/T 40396 Test method for glass transition temperature of polymer matrix composites
Dynamic Mechanical Analysis (DMA)

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Fickian diffusion fickiandiffusion Theoretical model describing the diffusion process of water molecules in carbon fiber reinforced composite materials.

Note. This model conforms to the one-dimensional second Fick's theorem.

3.2 Under given hot and humid conditions, as the exposure time increases, carbon fiber

reinforced composite materials gradually tend to have stable mechanical properties.

3.3 swelling ratio swelingratio Dimensional change rate of carbon fiber reinforced composite materials after exposure to hot and humid environment for a certain period of time.

4 Test principle

According to the water absorption rate, size, glass transition temperature and mechanical properties of carbon fiber reinforced composite material samples under certain humid and heat conditions