

ICS 77.040.10

CCS H 22



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 40410-2021

**Metallic materials - Multiaxial fatigue testing - Axial-torsional
strain-controlled method**

金属材料 多轴疲劳试验 轴向-扭转应变控制方法

Issued on: August 20, 2021

Implemented on: March 1, 2022

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

Table of Contents

1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and description	4
5 Principle	6
6 Sample	6
7 Test equipment	7
8 Test procedure	8
9 Data processing and analysis	10
11 Reference	12

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 of Standardization Documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing agency of this document is not responsible for identifying patents. This document was proposed by the China Iron and Steel Association. This document is under the jurisdiction of the National Steel Standardization Technical Committee (SAC/TC183). Drafting organizations of this document. Beijing University of Technology, Metallurgical Industry Information Standards Research Institute, Shenzhen Wance Test Equipment Co., Ltd., AVIC Shenyang Aircraft Design and Research Institute, Lixu (Shanghai) Scientific Instrument Co., Ltd., Beijing Aviation Materials Research Institute of Aviation Development, China Aviation Development Commercial Aviation Air Engine Co., Ltd., Central Iron and Steel Research Institute. The main drafters of this document. Shang Deguang, Dong Li, Li Fangdai, Li Daohang, Zuo Linxuan, Qu Linfeng, Liu Jianzhong, Chen Bo, Zhang Chengcheng, Tong Dihua, Gao Yifei, Wang Bin, Huang Xing, Hou Huining. Multiaxial fatigue test of metallic materials Axial-torsional strain control method

1 Scope

China's national method for multiaxial fatigue testing under combined axial and torsional strain control. It specifies the terms and definitions, the symbols and the procedure. Ordinary fatigue testing loads a specimen along one axis, and the resulting curve describes

a material under uniaxial cyclic stress. Real components are rarely loaded that way: a crankshaft, a drive shaft, a turbine disc and a welded joint all see combinations of tension and shear that vary through the cycle, and the phase between the two matters as much as their magnitudes. Out-of-phase loading, where the axial and torsional peaks do not coincide, causes the principal stress direction to rotate through the cycle, and materials fail sooner under it than any uniaxial prediction suggests. Testing it requires a machine that can apply and control both simultaneously, which is why the method is standardised - the results are only comparable if the strain path is defined exactly.

This document specifies the principles, specimens, test equipment, test procedures, data According to processing analysis and test reports. This document is applicable to the application of constant amplitude and symmetrical loading waveforms and axial and axial and Axial-torsion composite fatigue test with the same frequency in the torsion waveform.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, dated quotations Only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to This document.

GB/T 228.1 Tensile Test of Metallic Materials Part

3 Terms and definitions

The following terms and definitions defined in GB/T 10623 and GB/T 26077 apply to this document.

3.1 Axial strain The ratio of the elongation ΔL_g of the extensometer gauge length to the extensometer gauge length L_g is calculated by formula (1). $\epsilon = \Delta L_g / L_g$ (1)

Note. Refer to the definition of axial strain in engineering strain.