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Metallic materials - Very high cycle fatigue - Ultrasonic fatigue test method

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Foreword

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With the development of industrial technology, some engineering parts, such as engine parts, automobile load-bearing parts, railway axles and tracks, aircraft, Bridges and special medical equipment, etc:, are subjected to cyclic loads, and their actual service life exceeds

107 cycles, and even reaches 109 cycles: In recent years, there are more and more ultra-high cycle load-bearing parts, and the demand for ultra-high cycle fatigue testing of metal materials is increasing day by day: Ultrasonic fatigue testing is a method to complete ultra-high cycle fatigue testing: One of the effective means of high cycle fatigue: Compared with high cycle fatigue, ultrasonic fatigue has a much higher test frequency, specimen size design, stress control etc: are different from high cycle fatigue, and high cycle fatigue test methods are no longer suitable: Ultrasonic fatigue testing has the following characteristics due to its ultra-high operating frequency:

--- Accelerate fatigue test and significantly shorten fatigue test cycle;

---Can carry out ultra-high cycle (such as 108 cycles, 109 cycles or even 1010 cycles) fatigue tests on metal materials of parts/structures: Very high cycle fatigue of metal materials Ultrasonic fatigue test method

1 Scope

China's national ultrasonic fatigue test method for very high cycle fatigue of metals. Conventional fatigue testing runs at tens of hertz, so reaching ten million cycles takes days and a billion cycles is impossible. Yet a billion cycles is what a turbine blade, a railway axle, an engine valve spring or an implant accumulates in service, and the assumption that steel has a fatigue limit below which it never fails turned out to be false at those numbers: failures continue to occur, initiating not at the surface as classical fatigue does but at internal inclusions, producing the characteristic fisheye fracture. Testing there requires resonating the specimen at twenty kilohertz, which reaches a billion cycles in a day. The method has to address what that entails - the specimen must be designed to resonate, and the heat generated at that frequency has to be removed or the test measures something else.

This document specifies the test specimens, test equipment, test procedures and test methods for ultra-high cycle fatigue ultrasonic fatigue test of metallic materials at room temperature: Report: This document is applicable to ultra-high cycle fatigue with a test frequency of:20000Hz±500Hz, single-end axial excited vibration, and stress ratio R=-1 test: Fatigue tests with other stress ratios or ultrasonic resonance frequencies can refer to this method, and the corresponding specimens need to be designed and verified separately: This document does not cover notched specimens, but the fatigue test procedures described in this document can be applied to very high cycle fatigue testing of notched specimens:

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/T 2614 Nickel-chromium-nickel-silicon thermocouple wire

GB/T 3075 Axial force control method for fatigue test of metallic materials

GB/T 38897 Ultrasonic measurement method for elastic modulus and Poisson's ratio for non-destructive testing

JJF1305 Linear Displacement Sensor Calibration Specification JJG623 Resistance Strain Gauge JJG856 Working Radiation Thermometer

3 Terms and definitions

The terms and definitions defined in GB/T 3075 and the following apply to this document: 3:

1 Very high cycle fatigue veryhighcyclefatigue Fatigue with a cycle frequency greater than 107: 3:

2 Fatigue test with cyclic stress applied at ultrasonic resonant frequency: 3:

3 Fatigue specimens that meet the requirements of ultrasonic frequency resonance:

4 Symbols and instructions

The symbols used in this document and their corresponding descriptions are shown in Table 1: