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**Metallic materials - High strain rate compression test method at
ambient temperature**

金属材料 高应变速率室温压缩试验方法

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009. This standard is proposed by China Iron and Steel Association. This standard by the National Standardization Technical Committee Steel (SAC/TC183) centralized. This standard was drafted by the Chinese Academy of Engineering Physics, Institute of Engineering, Steel Yanakeke Detection Technology Co., Ltd., China Science and Technology University of Technology, Northwestern Polytechnical University, Baoshan Iron and Steel Co., Ltd., Metallurgical Industry Information Standards Institute. The main drafters of this standard. Zhong Weizhou, Hu Wenjun, Gao Yi Fei, Hu Shisheng, Xu Weifang, Guo Weiguo, Fang Jian, Dong Li.

Dynamic mechanical properties of materials parameters is to study traffic collision, space debris impact, weapon damage and other structural impact response of the basic data. high The compressive property of metallic materials under strain rate reflects the mechanical characteristics of materials such as plastic flow under dynamic compressive load and strain rate effect, Is the key material parameter in the structural design, optimization and manufacture. It is an important parameter to establish the large plastic deformation constitutive model and failure criterion of material, It is also an indispensable basis for numerical simulation of impact behavior of metallic materials. When the metal material is high The strain rate deformation, many of the dynamic mechanical properties (such as yield strength, failure strain) showed strain rate dependence. High-speed impact Under the conditions of metal materials undergoing the strain rate as high as $10^2\text{s}^{-1} \sim 10^4\text{s}^{-1}$, much higher than the strain rate GB/T 7314-2005 (10^{-5}s^{-1} to 10^{-4}s^{-1}). Therefore, through the high strain rate compression test method for testing the dynamic mechanical properties of metal materials, metal Structural design of the selection of materials, optimization, processing and numerical evaluation has important engineering significance. Hopkinson compression test is to study the material in the strain rate range of $10^2\text{s}^{-1} \sim 10^4\text{s}^{-1}$ main mechanical properties of the test method, based In one-dimensional elastic stress wave and sample stress and strain distribution uniformity assumption, according to one-dimensional wave propagation theory to solve the waveguide rod and the end of the specimen should Force-displacement-time relationship, so as to get the stress-displacement-strain relationship of the specimen. The test device has a simple

structure, sophisticated measurement methods, exercise For convenience, load waveform easy to control the characteristics of the design by loading pulse width and sample size, so that the specimen in the process of deformation in the dynamic balance State, so that the sample deformation analysis without considering the effect of fluctuations in the stress wave effect and strain rate effect successfully decoupled to obtain the material in the high Mechanical properties at strain rate. This standard and GB/T 7314 together constitute the evaluation of metal materials at room temperature low strain rate and high strain rate under the compression load Performance test methods. metallic material High strain rate room temperature compression test method

1 Scope

China's national method for compression testing metals at high strain rate at room temperature. It specifies the terms and definitions, the symbols, the test principle, the equipment, the specimens, the procedure, the data processing and the test report, and it applies to strain rates between about 100 and 10000 per second. Metals do not behave the same way fast as they do slowly. A steel that yields at a given stress in a testing machine yields considerably higher when it is deformed a thousand times faster, because dislocations need time to move and at high rate they cannot keep up. That difference is not a curiosity: it decides how a car body absorbs a crash, how armour responds to an impact, how a forging fills a die and how a machining chip forms. Ordinary testing machines cannot reach these rates, so the test uses a split Hopkinson pressure bar - the specimen is placed between two long elastic bars and a striker sends a stress wave through it, with the strain gauges on the bars recording what the specimen did in a few tens of microseconds.

This standard specifies the terms and definitions of the high strain rate compression test method of metal materials, symbols and descriptions, test principles, test equipment, Samples, test procedures, test data processing and test reports. This standard applies to room temperature metal materials in the 102s-1 ~ 104s-1 strain rate range of compressive stress - strain curve and other mechanical properties The determination.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version applies to this article Pieces. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 1804 General tolerances Tolerances for linear and angular dimensions without tolerances

GB/T 2975 steel and steel products mechanical properties test sampling location and specimen preparation

GB/T 7314 metal materials at room temperature compression test methods

GB/T 10623 metallic materials mechanical properties test terms

GB/T 13992 metal paste resistance strain gauge

GB/T 32967.1 metal materials high strain rate torsion test - Part 1. Room temperature test method JJG623 resistance strain gauge

3 Terms and definitions

GB/T 10623 and GB/T 32967.1 defined and the following terms and definitions apply to this document.

3.1 Elastic longitudinal wave elasticlongitudinalwave Elastic stress wave whose mass direction is parallel to wave propagation direction.

3.2 Longitudinal wave velocity c_b Propagation velocity of elastic longitudinal wavefront.

3.3 Split Hopkinson pressure bar splitHopkinsonpressurebar A Hopkinson Bar for Testing Mechanical Properties of Sample Compression Stress - Strain Curves at High Strain Rate.

3.4 Waveguide rod barforwavetransmit The input rod and output rod in the test device are used for the conduction of elastic stress wave to realize the loading of the sample.