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

GB/T 30069.1-2013

**Metallic materials -- Tensile testing at high strain rates -- Part 1:
Elastic-bar-type systems**

金属材料 高应变速率拉伸试验 第1部分：弹性杆型系统

(English Translation)

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Foreword

GB/T 30069 "metallic material with a high strain rate tensile test" is divided into two parts.

--- Part 1. elastic rod systems;

--- Part 2. hydraulic servo and other test systems.

This section GB/T Part of 130,069.

This section drafted in accordance with GB/T 1.1-2009 given rules.

This section uses redrafted Law Amendment uses ISO 26203-1:2010 "metallic material with a high strain rate tensile testing - Part 1.

Elastic rod systems. " this part of ISO 26203-1:2010 technical differences and their reasons are as follows.

--- On normative references, this part has been adjusted technical differences, in order to

adapt our technical conditions, the case focused Reflected in Chapter 2, "Normative references", the specific adjustments are as follows.

- Modify with international standards of GB/T 228.1 instead of ISO 6892-1 (see Chapters 1 and 7.1);
- Added references GB/T 10623 "test the mechanical properties of metallic materials the term" (see Chapter 4);
- increase the informative Appendix D "Instrumented impact tensile method (IIT) Example";

This part made the following editorial changes.

- Use the "standard" instead of "this International Standard";
- Deleted international standards foreword;
- Delete references [17].

This part is proposed by the China Iron and Steel Association.

This part of the National Steel Standardization Technical Committee (SAC/TC183) centralized.

This section is drafted. Baoshan Iron & Steel Co., Ltd., Shanghai Electric Power Generation Equipment Co., Ltd. Shenzhen million test test Equipment Co.

Division, Wuhan Iron and Steel (Group) Company Institute of Iron and Steel Research Institute.

Introduction

Sheet metal high strain rate tensile test is very important in terms of reliability analysis for a vehicle crash. In the event of a crash, the maximum should be Variable rate often can reach 103s-1, in this case the strength of the material will be significantly higher than the performance of the quasi-static loading. Therefore, material characterization Input parameters material strain rate sensitivity of accuracy will directly affect the reliability of the collision simulation.

Although there are a variety of high strain rate test method, but the following three issues still need an effective solution.

1) noise-related force measurement signals

--- Test force is usually detected by measuring points on the force measuring device and the measuring device and the sample are often spaced a certain distance.

--- In addition, the reflection would have folded the arrival end of the force measuring device by an elastic wave measurement point. If the test of time and stress waves through Propagation time measuring device rather than the stress - strain curve due to the

superposition of the direct wave and the indirect wave and severe vibration swing. In contrast, in the quasi-static test, the test of time long enough to have several times in the round-trip time of the elastic wave, and thus test Force means any part of the force signal has reached saturation and equilibrium.

There are two distinct solutions to address the problem.

a) Use shorter force measuring device in order to facilitate faster to reach equilibrium. Hydraulic servo systems often use this approach.

b) the use of longer force measuring device, when the reflected wave reaches the force measuring point test has been completed. Elastic rod type system that is based on this method.

2) fast and accurate method for measuring displacement or elongation of the specimen

--- General extensometer because there is a big inertia effect does not apply. Non-contact measurement methods such as optical and laser device can be used High strain rate. According to the use of means for measuring the displacement of the elastic wave propagation theory of rational design methods are also possible, such as in Some examples of the criteria discussed.

--- End of the displacement of the rod with the same load data obtained by simple calculation, for example, in a particular lever position recording strain change with time Process. Therefore, the elastic rod type system does not need to assess the stiffness of the device.

3) along the uneven distribution of the sample force in the quasi-static tests, it is recommended using a standard sample in order to facilitate a longer parallel part of the larger arc of the transition from a single site to achieve uniform Axis stress state. In the dynamic test due to test the force required to effectively meet the equilibrium condition, the sample design is different from the typical quasi-static test specimen.

Compared with the quasi-static test, dynamic in which the specimen is generally parallel to the loading axis direction sized smaller.

Elastic rod systems to solve the above problems provides an effective test solutions, widely used in high 10^3 s-1 strain rate range and to obtain accurate stress - strain curve.

International Iron and Steel Institute (InternatioallronandSteelInstitute, IISI) based on various types of real Laboratory comparison test between the release of the "dynamic tensile steel test recommended approach." Comparative test results show that the application of elastic rod systems available Quality data results.

Metallic material with a high strain rate tensile test Part 1. The elastic rod systems

1 Scope

This section GB/T 30069 specifies the elastic rod-shaped sheet metal stress measurement system at high strain rates - strain characteristics experiment method.

Based on the experimental and numerical calculation, such as crash finite element simulation (FEA) indicates that, in the strain rate within $10^{-3}\text{s}^{-1} \sim 10^3\text{s}^{-1}$ Scope and Closely related to vehicle collisions.

Stress is an accurate assessment of vehicle crashworthiness performance, higher than 10^{-3}s^{-1} strain rate under reliable metallic materials - strain characteristics Particularly critical.

This section applies to 10^2s^{-1} strain rate tensile test method above range.

Note 1: When the strain rate is less than 10^{-1}s^{-1} , can use the quasi-static tensile tester GB/T 16825.1 specified in [1]. Strain rate is lower than 0.0067s^{-1} , The direct use of GB/T 228.1 Test method; strain rate in $0.0067\text{s}^{-1} \sim 0.1\text{s}^{-1}$ Scope, refer to GB/T 228.1 Methods test.

Note 2: In addition to the provisions of this section a rectangular cross-section sample interview outside, this part is equally applicable to other tensile specimen geometry.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the edition dated applies to this file. For undated references, the latest edition (including all repair orders) applies to this document.

GB/T 228.1-2010 tensile testing of metallic materials - Part 1. room temperature test methods (GB/T 228.1-2010, ISO 6892-1:2009, MOD) GB/T 10623 test the mechanical properties of metallic materials terminology (GB/T 10623-2008, ISO 23718:2007, MOD)

3 Test principle

This section is used to evaluate the stress of metallic materials at high strain rate - strain characteristics.

Low strain rate (less than 10^{-1}s^{-1}) test can be used to carry out quasi-static tensile testing machine. However, when compared with the use of such test machine implementation Special attention shall be when conventional high strain rate tests. This section shall use a sample of high strain rate test method specified in Appendix A to mention Detailed procedures for such tests.

When the strain rate is higher than the 10s^{-1} , quasi-static force sensor used in the test due to multiple reflected waves will cause serious signal strength value interference. Therefore, the force required using a special measurement technique, can be realized by the following