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ASSOCIATION STANDARD

T/CSAE 52-2016

Test method of mechanical properties for metallic sheets at high strain rates

金属板材在高应变速率下的力学性能测试方法——液压伺服控制系统及其他控制系统

(English Translation)

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Foreword

According to the current mechanical and electrical test schemes for metal materials at home and abroad at high strain rates, the test equipment can be divided into two categories.

Elastic rod type system, the other type is hydraulic servo and other test systems.

This standard only applies to hydraulic servo and other servo test systems.

This standard uses the quasi-translation method to refer to ISO 26203-2:2011 "Metal material high strain rate tensile test Part 2. liquid Pressure servo and other test systems" and SEP 1230 "Mechanical properties of sheet metal at high strain rates in high-speed tensile tests determine".

The technical differences between this standard and ISO 26203-2:2011 and SEP 1230 and their reasons are as follows.

a) Regarding the scope, this standard requires that different strain rates selected for sheet

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metal of the same specification should be performed on the same test equipment.

To ensure comparability of test data (see Section 1);

b) Regarding the standard reference documents, the ISO /6892 is replaced by the international standard GB/T 228.1 to adapt to China.

Technical conditions (see section 2).

c) replace "this International Standard" with "this standard";

d) Replace the comma ',' as a decimal point with a decimal point '.';

e) deleted the preface to international standards;

f) In order to ensure the reliability of the test data, this standard stipulates the calibration of the test equipment;

g) Regarding the sample, make the following adjustments.

- Added calibration protocols for test equipment to ensure the reliability of test data (see Section 6.1);

- Increased processing of test samples after the material has passed the process path (see Section 6.1);

- Added instructions for testing non-plate materials or metal materials with a thickness greater than 3 mm (see Section 6.2);

- Increased the convention for sampling direction (see Section 6.3);

- Increased the number of samples required during the test (see Section 6.3);

h) Regarding data processing, due to the limited strain rate set by the test, this standard adds material constitutive model determination and gives Publish and verify the constitutive model (see Section 7.5.5);

i) Regarding the test report, make the following adjustments (see Section 8).

- Added requirements for the processing conditions and processing conditions of the sample;

- Added requirements for the location and direction of the sampling;

- Added requirements for the measurement of load and strain;

- Added requirements for the measurement of load and strain;

- Increased the number of requirements for valid data;

- Added requirements for material constitutive models and parameters;

This part is proposed by the Materials Division of the China Automotive Engineering

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Society.

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This section drafted by. China Automotive Engineering Research Institute Co., Ltd.

Introduction

Many engineering materials exhibit a sensitivity to strain rate dependence, ie strain rate. To some extent, strain rate the higher the yield strength of the material, the better the energy absorption of the material. This test method is very useful for evaluating the collision of automotive structures.

important. At present, the crashworthiness of automotive structures is increasingly evaluated by numerical simulation methods, and numerical simulation can be minimized.

Cost and shortest time consumption replace traditional crash tests. What is required for numerical simulation analysis is the response of the material at high strain rates.

Force strain curve. The quasi-static value is obtained according to GB/T 228.1, that is, the strain rate is <=0.00025s-1, but this is for describing the dynamic load.

The deformation of the material of the loaded part is unsuitable, and the required strain rate under dynamic load is generally >=10-2 s-1.

T/CSAE XX-XXXX

Test method for mechanical properties of sheet metal at high strain rate

--Hydraulic servo control system and other control systems

1 Scope

This standard specifies the principles, symbols and descriptions, specimens and devices for tensile testing of automotive sheet metal at high strain rates.

This standard is applicable to automotive sheet metal with a thickness of 3mm or less (including 3mm). The strain rate required for the test is 10-2s-1~ 103s-1, test temperature is 10 ° C ~ 35 ° C (or by mutual agreement).

This standard applies to hydraulic servo test systems. Unless otherwise stated, different strain rates are selected for sheet metal of the same specification.

It should be done on the same test equipment.

Note 1: When the strain rate of the test is less than 10-2s-1, the comparison test can be carried out using a quasi-static tensile tester.

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2 Standard reference documents

The following documents are indispensable for the application of this document. For dated references, only the dated version applies.

This document. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 228.1-2010 tensile testing of metallic materials - Part 1 Metallic materials - High strain rate tensile test methods - Part 1 . Elastic rod systems;

ISO 26203-2. High-strength tensile test methods for metallic materials - Part 2. Hydraulic servo control and other control systems;

Determination of the mechanical properties of sheet metal at high strain rates in SEP 1230 high speed tensile test;

ASTM E 1012-2012 Standard Practice for Verifying Test Frame and Sample Alignment under Tensile and Compressive Axial Forces;

GB/T 2975 steel and steel products mechanical properties test sampling position and sample preparation.

3 Symbols, names and units

The symbols, names and units used in this standard are shown in Table 1.

Table 1 Symbols and descriptions

Symbol unit description Sample A0 mm original thickness of the sample B0 mm original width in the gauge length Bk mm width of the sample holding portion L0 mm sample original gauge length Lc mm sample parallel length Le mm extensometer gauge length T/CSAE XX-XXXX

Table 1 Symbols and descriptions (continued)

r mm The radius of the transition arc connecting the parallel section of the specimen to the clamping section Original cross-sectional area of the parallel length portion of the S0 mm2 specimen SD mm2 dynamometer area. the area of the fixed end of the sample, only the elastic deformation section is required during the test Symbol unit description time Ts time Tf s The time from the start of the test to the time the sample broke Elongation A % Elongation after break Note. The symbol A of a non-proportional sample often has a subscript, such as. A20mm indicates the original sample Elongation after breakage of gauge length L0 = 20 mm.

Elongation

Ag % Plastic elongation at maximum force Fm (plastic strain at maximum force Fm) Agg %

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