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**Metallic materials - Measurement of indentation tensile
properties and residual stresses by an instrumented
indentation test**

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Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 Standardization Guidelines Part 1: Structure and Drafting Rules of Standardization Documents

Drafting:

This document uses the redrafting method with reference to ISO /T R29381:2008 "Metallic material instrumented indentation test to determine mechanical properties

"Mark Tensile Performance" is compiled, and the degree of consistency with ISO /T R29381:2008 is not equivalent:

The main differences between this document and ISO /T R29381:2008 are as follows:

---Modify the standard name to "Metal material instrumented indentation method to determine the tensile properties and residual stress of indentation", adding the measurement of residual

For the stress part, use the instrumented indentation test method to determine the indentation tensile properties and residual stress;

---Modified the scope, deleted the description of the three methods in Chapter 1 of ISO /T

R29381:2008, and added the description of residual stress;

---Modified the terms and definitions, and added the terms and definitions of spherical indenter and Vickers indenter;

---Modified the symbol and description, and added the symbol and name of the residual stress part;

---Retained ISO /T R29381:2008 stress strain method 5:1:1 principle and 5:1:16 data analysis as the 5:1 pressure of this document

The principle of measurement of tensile properties of traces is adjusted, and A:3 of ISO /T R29318 Appendix A is adjusted as 5:2 of this document for residual stress measurement:

The content principle is modified and the content is modified; the finite element analysis method and neural network method that are not directly effective without the stress-strain method are deleted

Content, enhance the operability of the instrumented press-in test method;

---Added the residual stress test procedure:

This document was proposed by the China Iron and Steel Association:

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Introduction

This document provides methods for measuring tensile properties and residual stresses of metallic materials using instrumented indentation tests: Indentation test with spherical indenter

At the same time, measure the indentation test force-depth curve, and obtain the indentation yield strength, tensile strength and strain hardening index through this curve:

To characterize the tensile properties of metal materials: The Vickers indenter and the spherical indenter were pressed into the surface of the sample respectively, and the measured stress and non-response were compared:

The indentation test force-depth curve of the metal material in the state of force is used to obtain the surface residual stress of the metal material sample or component:

Due to the small diameter of the indenter and the shallow indentation depth, the instrumented indentation test method is a non-destructive or micro-destructive test method: Especially suitable for

Test the tensile properties and residual stress when the on-site equipment and components cannot be cut or the material is too small to make standard samples:

It is determined that it has significant advantages and broad application prospects in the rapid inspection of raw materials, small sample inspection and safety assessment of in-service engineering components:

Compared with the uniaxial tensile test, the indentation tensile performance obtained by the instrumented indentation test more reflects the local performance of the metal material:

Can be completely equivalent to uniaxial tensile properties: But when the tensile test cannot be carried out, this method can be used as a good supplement and reference:

Instrumented indentation method for metal materials

Indentation tensile properties and residual stress

1 Scope

This document specifies the terms and definitions, symbols and descriptions of the instrumented indentation test method for indentation tensile properties and residual stress of metallic materials:

Test principle, test machine, sample, test procedure, uncertainty of result and test report, etc:

This document is applicable to the instrumental indentation method determination of indentation tensile properties and residual stress of metallic materials: Instrumented indentation test

The classification of GB/T 21838:1 belongs to the macroscopic range, and the press-in test force is 2N~3kN:

2 Normative references

The contents of the following documents constitute indispensable clauses of this document through normative references in the text: Among them, dated quotations

Only the version corresponding to the date is applicable to this document: For undated references, the latest version (including all amendments) is applicable to

This document:

GB/T 21838:1-2019 Instrumental indentation test for hardness and material parameters of metallic materials-Part 1: Test method

(ISO 14577-1:2015, IDT)

GB/T 21838:2 Instrumental indentation test for hardness and material parameters of metallic materials-Part 2: Inspection and calibration of testing machines

(GB/T 21838:2-2008, ISO 14577-2:2002, MOD)

JJF1059:1-2012 Measurement Uncertainty Evaluation and Expression

3 Terms and definitions

The following terms and definitions apply to this document:

3:1

Instrumented indentation test

IIT

The test method of mechanical properties of metal materials is obtained by continuously recording the test force-depth curve when the indenter is pressed into the sample:

3:2

Spherical indenter

The head is a spherical indenter:

3:3

Vickers indenter

The top is a square pyramid diamond indenter with an angle of 136° between two opposite faces:

3:4

Indentation tensile properties

Continuously record the indentation test force-depth curve of the metal material through the instrumented indentation test, and analyze it by establishing the stress-strain relationship

The tensile properties obtained include indentation yield strength, indentation tensile strength, strain hardening index, etc: