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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 26140-2023

Non-destructive testing - Standard test method for determining residual stresses by neutron diffraction

无损检测 残余应力测量的中子衍射方法

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Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for Standardization Work Part 1: Structure and Drafting Rules for Standardization Documents" drafting: This document replaces GB/T 26140-2010 "Neutron Diffraction Method for Measuring Residual Stress in Nondestructive Testing", and GB/T 26140- Compared with:2010, except for structural adjustment and editorial changes, the main technical changes are as follows:

a) Changes and additions of some terms and definitions (Chapter 3, Chapter 3 of the:2010 edition);

b) Added requirements for measurement purpose and sample geometry (see 6:1, 6:2, 6:3);

c) Changed the selection requirements of the diffraction crystal plane (see 7:3:1:2, 6:3:1:2 of the:2010 edition);

d) Changed the requirements for measuring strain based on time-of-flight devices (see 7:3:2, 6:3:2 of the:2010 edition);

e) Changed the requirements for the positioning process (see 7:4, 6:4 of the:2010 edition);

f) Changed the requirements for determining the unstrained or reference lattice spacing (see 7:6, 6:6 of the:2010 edition);

g) Changed the result reliability requirements (see Chapter 10, Chapter 10 of the:2010 edition);

h) Added reporting requirements for uncertainty and error (see 11:7): This document is equivalent to ISO 21432:2019 "Neutron Diffraction Method for Nondestructive Testing

Residual Stress Measurement": The following minimal editorial changes have been made to this document:

--- Corrected the unit symbol of Planck's constant in 4:1, and changed "Js" to "J s";

---Corrected the symbols of azimuth angles in 4:1, 4:2, 9:3 and Figure 11, uniformly changed the lowercase to uppercase, and changed the xy plane in Figure

11 The angle psi is changed to to make it consistent with formula (14) ~ formula (16);

--- Corrected the sign of the scattering angle in Figure 2, and changed "2thetaa" to "2theta";

---Correct the representation of the crystal plane corresponding to the diffraction peak in 5:4:3, and change "hkl" to "(hkl)";

1 Scope

GB/T 26140-2023 gives the neutron diffraction method for measuring residual stress. It is the only technique that measures stress deep inside a component without cutting it: neutrons penetrate centimetres of steel, and the shift in the lattice spacing they diffract from gives the strain at a defined gauge volume within the part. That makes it the reference against which X-ray and hole drilling methods are judged, and the way welds, forgings and additively manufactured parts are validated - at the cost of needing a research reactor or spallation source. The standard sets the purpose of the measurement and the specimen geometry and material considerations, the measurement preparation, the measurement and recording requirements, the calculation of stress from the measured strains, the reliability of the results and the report, with informative annexes on the measurement and analysis methods and on the uncertainty of the measured quantities. It replaces GB/T 26140-2010 and took effect on 23 May 2023.

This document specifies a method for measuring residual stress in polycrystalline materials by neutron diffraction: This document is applicable to homogeneous, heterogeneous and containing different crystal Phase material sample testing: This document briefly describes the principles of the neutron diffraction technique and provides the following recommendations:

---Appropriate diffraction crystal plane selection for measurements that should be carried out for different types of materials;

--- Selection of sample orientation in suitable measurements;

---The selection of the volume to be measured is related to the grain size and stress state of the material to be tested: This document specifies the procedure for accurately locating and aligning the detection site within the neutron beam, and the procedure for accurately defining the sample volume of the material used for the measurement: process: This document specifies the precautions for calibrating neutron diffraction devices and specifies

the technical method for obtaining stress-free reference values: This document specifies various methods for performing neutron diffraction measurements, provides procedures for analyzing results and determining their statistical correlation, provides Recommendations for the determination of reliable estimates of residual stress from strain measurement data and for the assessment of the uncertainty in the results:

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text: Among them, dated references For documents, only the version corresponding to the date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to this document: EN 13925-3:2015 X-ray diffraction for non-destructive testing of polycrystalline and amorphous materials Part 3: Apparatus (Non- ments)

3 Terms and Definitions

The following terms and definitions apply to this document: ISO and IEC maintain the following terminology databases for standardization work:

---ISO online browsing platform, the URL is https://www:iso:org/obp; 3:1 neutron absorption neutron absorption The phenomenon of neutrons being captured by atomic nuclei:

Note: See reference [1] for the table of nuclear capture cross sections: 3:2 correction alignment The adjustment made to the position and orientation of the sample and all components of the apparatus so that measurements can be made accurately at the expected sample location: