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Replacing GB/T 8651-2002

Flaw Detection Method by the Ultrasonic Plate Wave for Metal Plates

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Foreword

This Standard is drafted in accordance with stipulations in GB/T 1.1-2009.

This Standard serves as a replacement of GB/T 8651-2002 Metal Plates - Flaw Detection Method by the Ultrasonic Plate Wave. In comparison with GB/T 8651-2002, there are several main technical changes as follows:

- The requirements of detectors are added;
- The requirements of contrast sample size are modified;
- In terms of grooved artificial defects, U-shaped groove is added;
- The stipulations on the alternation of phase velocity curve and group velocity curve of different plates of materials are added.

This Standard was proposed by China Iron and Steel Industry Association.

This Standard shall be under the jurisdiction of National Technical Committee 183 on Iron and Steel of Standardization Administration of China (SAC/TC 183).

The drafting organizations of this Standard: Central Iron & Steel Research Institute, China Metallurgical Information and Standardization Institute, NCS Testing Technology Co., Ltd.

The main drafters of this Standard: Zhang Jianwei, Fanhong, Zhangke, Shen Haihong, Jia Huiming, Dongli.

The release of previous versions of the standard replaced by this Standard is as follows:

- GB/T 8651-1988, GB/T 8651-2002.

Flaw Detection Method by the Ultrasonic Plate Wave for Metal Plates

1 Scope

This Standard specifies the terms, definitions, general requirements, flaw detection equipment, contrast sample, selection of plate wave mode, flaw detection method and flaw assessment of flaw detection method by the ultrasonic plate wave for metal plates.

This Standard is applicable to flaw detection by the ultrasonic plate wave for metal plates whose thickness is not more than 5 times of the surface wavelength of detected plates. However, it must be confirmed that the stimulated sound wave is plate wave, and flaw detection can be conducted under sufficient sensitivity of flaw detection.

2 Normative References

The following documents are indispensable to the application of this Standard. In terms of references with a specified date, only versions with a specified date are applicable to this Standard. The latest version (including all the modifications) of references without a specified date is also applicable to this Standard.

GB/T 9445 Non-destructive Testing - Qualification and Certification of Personnel

GB/T 12604.1 Non-destructive Testing - Terminology - Terms Used in Ultrasonic Testing

JB/T 10061 Commonly Used Specification for A-mode Ultrasonic Flaw Detector Using Pulse Echo Technique

3 Terms and Definitions

Those defined in GB/T 12604.1, and the following terms and definitions are applicable to this Standard.

3.1 Mode

Mode refers to the relation between the displacement direction and transmission direction of particles. In plate wave, the mode of wave suggests the variation mode of particle displacement to the plate center during the process of sound transmission. Plate wave can be divided into symmetrical and asymmetrical. Different models and orders of plate wave shall be represented in different forms. Generally speaking, SH wave shall be expressed in $n_0, n_2, n_4, \dots$ (symmetrical) and $n_1, n_3, n_5, \dots$

(asymmetrical). Lamb wave is generally expressed in S_0 , S_1 , S_2 , (symmetrical) and a_0 , a_1 , a_2 , (asymmetrical).

4 General Requirements

4.1 Flaw detection by plate wave can be conducted with piezoelectric transducer or electromagnetic acoustic transducer. No matter which type of transducer is adopted, the sensitivity of flaw detection shall be guaranteed. The center frequency of transducer shall be consistent with the frequency of the emission and reception unit of detection equipment.

4.2 Detected plate shall manifest uniform thickness, smooth and flat surface; there shall be no liquid drops, oil stains, corrosion or other dirt.

4.3 Metallographic structure of detected plate shall not generate interference echo that might affect flaw detection during flaw detection.

4.4 The site of flaw detection shall avoid factors that might affect the stability of ultrasonic flaw detector or the reliable observation of flaw detectors, such as strong light, strong magnetic field, strong vibration, corrosive gas or severe dust, etc.

4.5 Flaw detectors shall have specialized knowledge on flaw detection by plate wave; flaw detectors shall obtain Ultrasonic Detection Qualification Certificate (Level-1 or above) in accordance with GB/T 9445. Issuers of flaw detection reports shall obtain Ultrasonic Detection Qualification Certificate (Level-2 or above).

5 Flaw Detection Equipment

5.1 The incident angle of piezoelectric probe chip shall maintain consistent, which can reduce the stimulation of unnecessary plate wave mode.

5.2 The performance of flaw detector shall comply with the requirements in JB/T 10061.

5.3 The other parts of flaw detection equipment, for example, transmission mechanism, shall guarantee the reliability and repeatability of the result of flaw detection.

6 Contrast Sample

6.1 Contrast sample shall be adopted to adjust the sensitivity of flaw detection system.

6.2 Contrast sample shall have the identical nominal thickness, identical or similar surface state, technological conditions and acoustic performance as detected plate; there shall be no internal natural macroscopic defects that might affect flaw detection.

6.3 Contrast sample shall be cut from finished plate; its long side shall be perpendicular

shall be minimized in the selection of plate wave mode and frequency. The plate wave mode selected by the demand side and the supply side shall be consistent.

8 Flaw Detection Method and Flaw Assessment

8.1 Flaw Detection Method

8.1.1 Comply with the selected initial sensitivity for artificial flaw detector, so that the echo height of all the artificial flaws can be adjusted to not lower than 80% of full-screen scale of the instrument. In addition, the instrument can have sufficient surplus sensitivity. In scanning, the sensitivity shall be raised at least 6 dB. In order to enhance flaw detection efficiency, the distance between the probe and artificial flaw shall be as large as possible.

8.1.2 The detection direction shall be vertical to the calendaring direction of plate material. If necessary, detect again along the calendaring direction.

8.1.3 During the usage of piezoelectric probe, the stability of acoustic coupling shall be guaranteed.

8.1.4 During the process of flaw detection, guarantee that the blind zone of plate edge is not more than 50 mm.

8.2 Flaw Assessment

8.2.1 When echo signal or edge reflected wave manifests abnormal location between the initial wave and edge reflected wave on the screen of the flaw detector, after eliminating interference factors and variation of the scanning distance, it shall be considered as a signal of flaw. In addition, further assess the size of the flaw and the echo height from other directions. In terms of stripe flaw, 6 dB attenuation method can be adopted to determine its indicated length.

8.2.2 Liquid droplet method or test block comparison method can be adopted to determine the location of flaw.

8.2.3 Ultrasonic thickness measurement or other appropriate methods can be adopted to verify the location and dimension of the detected flaw.

9 Flaw Detection Record and Report

9.1 Flaw detection record shall at least include the following main content:

- a) Texture (or steel plate number) of detected steel plate, plate material number, plate material specification, and number of flaw detection standard;

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