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Non-destructive testing — Acoustic emission testing — Verification of the receiving sensitivity spectra of piezoelectric acoustic emission sensors

Essais non destructifs — Contrôle par émission acoustique — Vérification des spectres de sensibilité de réception des capteurs d'émission acoustique piézoélectriques

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 9, *Acoustic emission testing*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The proposed method of determining the receiving sensitivity spectra of a piezoelectric acoustic emission sensor is based on a setup where the face of the sensor under test is directly coupled via a thin layer of coupling agent to the active face of a piezoelectric transmitter. The transmitter, usually an ultrasonic probe, stimulates the sensor under test by a particle displacement pulse in normal direction to the sensor's face. The displacement pulse is measured by a vibrometer at a number of positions on the active area of the transmitter. This allows determining the transmitting sensitivity of the transmitter in absolute units of nm/V and the receiving sensitivity of the sensor under test in absolute units of V/nm.

The aim is to establish uniformity of acoustic emission testing, to form a basis for data correlation, and to provide a basis for the uniform interpretation of results obtained by different acoustic emission testing organizations at different times. For more information about the verification methods for piezoelectric sensors, see Annex C.

Non-destructive testing — Acoustic emission testing — Verification of the receiving sensitivity spectra of piezoelectric acoustic emission sensors

1 Scope

This document specifies a method for the determination of the receiving sensitivity spectra of a piezoelectric acoustic emission sensor, in absolute units of volts output per motion input, whereby the motion can be particle displacement (e.g. in nanometres) or particle velocity (e.g. in millimetres per second) over a frequency range used for acoustic emission testing, from 20 kHz to about 1,5 MHz, whereby the sensor is stimulated by a motion pulse in normal direction to the sensor's face from a directly coupled piezoelectric transmitter.

This document also specifies a method for the determination of the transmitting sensitivity spectrum of a piezoelectric transmitter in absolute units, for example, in nanometres output per volt input, by measuring both the particle displacement pulse over the transmitter's active face and the transmitter's input voltage spectrum, using a scanning laser vibrometer.

This document does not include the known cancellation effects on a sensor's response, when the angle of incidence differs from normal (90°) or when the length of the wave passing across the sensor's sensitive face is shorter than about 10 times the dimension of the sensor's sensitive face.

This document does not specify a method to measure the influence of different materials on a sensor's sensitivity, but this effect is addressed in Annex F.

NOTE The methods described in this document can be considered for use with other than piezoelectric sensors, which detect motion at a flat face and work in the same frequency range.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12716, *Non-destructive testing — Acoustic emission inspection — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12716 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
transmitter
TM
piezoelectric device that converts an electrical signal to particle motion or pressure

Note 1 to entry: A single-letter TM identifier (TM-id A to Z) may be appended to identify a certain unit of transmitter.