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BSI Standards Publication

Ultrasonics – Methods for the characterization of the ultrasonic properties of materials

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ULTRASONICS – METHODS FOR THE CHARACTERIZATION OF THE ULTRASONIC PROPERTIES OF MATERIALS

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Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards

IEC TS 63081, which is a Technical Specification, has been prepared by IEC technical committee 87: Ultrasonics

The text of this Technical Specification is based on the following documents:

DTS	Report on voting
87/718/DTS	87/725/RVDTS

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

Words in **bold** in the text are defined in Clause 3. Symbols and formulae are in *Times New Roman + Italic*.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

Many ultrasonic measurement standards contain requirements for the properties of acoustic materials to be used to construct the measurement equipment relied upon within those documents. The following are examples of such standards.

- IEC 61161 specifies amplitude reflection factor and acoustic energy absorption for reflecting targets and absorbing targets and specifies amplitude transmission coefficient for anti-streaming foils.
- IEC 61391-1 discusses reflection coefficient.
- IEC 61689 defines echo reduction and specifies limits upon its values. The terms reflection loss and transmission loss are also used, and values specified.
- IEC TS 62306 specifies transmission loss and reflection amplitude reduction.
- IEC 62359 specifies reflection coefficient and absorption.
- IEC 60601-2-37 specifies reflectance and absorption coefficient.

As the list above suggests, a wide range of terms is used to specify the properties of an acoustic material, and these terms are not used consistently across IEC documents. Furthermore, there is a degree of duplication with multiple names for the same quantity. This is further confused since there is no document within the IEC ultrasonics portfolio that defines the methods by which those properties are measured.

This document seeks to address the shortcomings by providing:

- a clear unambiguous definition of the key quantities of interest during materials characterization;
- a discussion of similar terms and how they may relate to the key quantities;
- recommended experimental methods for determining the values of key quantities.

ULTRASONICS – METHODS FOR THE CHARACTERIZATION OF THE ULTRASONIC PROPERTIES OF MATERIALS

1 Scope

This document:

- defines key quantities relevant to ultrasonic materials characterization;
- specifies methods for direct measurement of many key ultrasonic materials parameters.

This document is applicable to all measurements of properties of passive acoustic materials under drive conditions that are not subject to nonlinear acoustic propagation. Whilst there are materials properties that may be of interest in a nonlinear drive regime, these are currently outside the scope of this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
absorption per unit length
α
component of the attenuation coefficient (IEC 60050-801:1994, 801-23-35) that does not arise from scattering and is due only to absorption of acoustic energy within the sample

$$\alpha = \alpha_0 \left| f^y \right| \tag{1}$$

where

α_0 is the absorption constant (dB/(MHz^y m));

f is the frequency in MHz;

y is the frequency exponent (in general not an integer).

Note 1 to entry: For absorption, y = 2 for water, and in general y is between 1 and 2 for fluids, soft tissues and tissue mimicking materials.

Note 2 to entry: **Absorption per unit length** is expressed in units of decibel per metre (dB/m).