A measuring of the sound absorption coefficient of structured materials produced by 3D printing

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Currently, industry is increasingly using 3D printing for the production of prototypes or small-lot products. 3D printing is significantly cheaper than other traditional production methods, saves material, time and money. The principle of operation of 3D printing is based on the systematic, step-by-step pre-set stacking of individual layers on top of each other, which creates the final product.

The aim of the contribution is to present the possibilities of using 3D FDM printing in the production of acoustic dampening materials designed to have the desired absorption properties. A simple circular samples with a diameter of 89 mm and three different thicknesses of 14, 20, 28 mm were produced using this method. In addition to the thickness, the internal structure of the samples was also changed. The prepared samples were tested using an impedance tube (1). The impedance tube made by us and the measurement of the acoustic properties of the test samples using it took place in accordance with the standards ASTM E 1050 (2) and ISO 10534-2 (3). A two-microphone method based on the calculation of transfer functions (2) was used to measure the absorption coefficient of the designed sample structures. The microphones were connected to the measuring center and to the PULSE system. PULSE Labshop software was used to estimate the frequency dependence of sound absorption coefficients.

The paper analyzes the experimentally obtained values of the absorption coefficient for different structures and thicknesses of samples produced by 3D printing. The measurements were evaluated in the range of frequencies from 100 Hz to 1600 Hz. White noise was used as the sound source.

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[1] ĎURIŠ, Rastislav - LABAŠOVÁ, Eva. The design of an impedance tube and testing of sound absorption coefficient of selected materials. In IOP Conference Series: Materials Science and Engineering. Vol. 1050, DMSRE, 07.-11. september 2020, Pavlov, ČR (2021), s.1-10. ISSN 1757-8981 (2021). V databáze: DOI: 10.1088/1757-899X/1050/1/01200 ; SCOPUS: 2-s2.0-85101685797.

[2] ASTM E 1050 1998 Standard test method for impedance and absorption of acoustical material using a tube, Two microphones and a digital frequency analysis system.

[3] ISO 10534-2 1998 Acoustics - Determination of sound absorption coefficient and impedance in impedance tubes - Part 2: transfer-function method.