

<<柔性材料振动吸声理论>>

图书基本信息

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前言

The sound absorption material plays an important role in room acoustic and environmental noise control. In general, the traditional sound absorption material is the porous material, perforated panel, plate and membrane material. British great classical physicist Lord Rayleigh put forward the micropore viscosity sound absorption theory of porous material more than 100 years ago. Zwicker and Kosten made further development of the theory 50 years ago. Although the research has undergone for more than 100 years, a majority of the scientists still follow such concept, the pore space of the porous material and perforated material produces the viscous effect on the fluctuating air of the sound wave, with which the sound energy is converted into heat energy. Whereas, the author discovered that the incident sound absorption coefficient of the fibrous material related to the thickness of the air layer behind it. When the thickness of the air layer is equal to $1/4$ of the wavelength of the incident sound wave, the maximum value of the sound absorption will be produced, when the thickness of the air layer is equal to $1/2$ of the wavelength of the incident sound wave, the minimum value of the sound absorption will be produced.

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内容概要

The sound absorption material plays an important role in room acoustic and environmental noise control. In general, the traditional sound absorption material is the porous material, perforated panel, plate and membrane material. British great classical physicist Lord Rayleigh put forward the micropore viscosity sound absorption theory of porous material more than 100 years ago. Zwicker and Kosten made further development of the theory 50 years ago. Although the research has undergone for more than 100 years, a majority of the scientists still follow such concept, the pore space of the porous material and perforated material produces the viscous effect on the fluctuating air of the sound wave, with which the sound energy is converted into heat energy.

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作者简介

Doctor Xin-an Zhang was born January 1963. He won the mathematical competition prize in 1978 when he was a senior middle school student in Xianyang City. In 1981 at the age of 18, he graduated from Northwest Institute of Textile Science and Technology, where he remained as a faculty member and went on to earn his Masters degree in 1989. Since then, he was employed as the associate professor of Xian Polytechnic University. Being well acquainted and good sense of fibrous materials with the research achievements of physical properties of fibrous materials. In 2004, he was taken in Tongji University as the Ph.D. student to perform the research in sound absorption properties of fibrous materials. When not teaching and writing, Zhang pursues his interest in acupuncture meridians and exercises Taiji, which he believes can prolong life and anti-decease.

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In chapter 3, the author has discovered that the sound absorption of fibrous materials is actually in direct proportion to the relative amplitude of the sound wave and obtained accordingly a mathematical relation expression that the sound absorption coefficient changes with the frequency. The theoretic spectra worked out by this relation expression tally satisfactorily with the measured spectra of the materials with various cavity depth. Further analysis has been made in this chapter concerning this viewpoint, considering that the sound wave actually pushes the material to vibrate. Due to the forced vibration, the sound energy is absorbed, thus producing a higher sound absorption coefficient. This viewpoint can interpret an acoustic phenomenon, that is, when a fabric is used as a wall facing or a face protective material of a sound absorber, the sound absorption coefficient is zero or very small, whereas when the fabric hangs independently or there is an air layer behind, there is a very high sound absorption coefficient. When applying the membrane vibration theory, micropore viscous sound absorption theory and the perforated plate resonance theory to the thin fibrous layer, the author has found that the viewpoint that the sound absorption of the fibrous layer comes from the vibration of the material is acceptable. At the same time, the conclusion arrived at in this chapter that the diameter of the yarn in the fabric is directly proportional to its specific acoustic impedance as an example, has proved this viewpoint.

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