



Fifth lecture

*Characterization Of Materials — II:
Electrical, Optical, X-Ray
Absorption, Acoustic, Ultrasonic*

Fourth Stage

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What is characterization of a material?

Material characterization is the process of measuring and determining physical, chemical, mechanical and microstructural properties of materials.

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In addition to the mechanical, thermal, and surface properties of materials, other physical properties could be important in particular applications of biomaterials. Properties considered in this chapter include electrical, optical, absorption of x-rays, acoustic, ultrasonic, density, porosity, and diffusion.

What is electronic characterization?

Electrical characterization can be used to determine resistivity, carrier concentration, mobility, contact resistance, barrier height, depletion width, oxide charge, interface states, carrier lifetimes, and deep level impurities.

What is the importance of electrical characterization?

Electrical characterization of the TSV impedance is necessary to properly model the delay and power consumption of intertie signals. The key contributions of this chapter are summarized as follows: Closed-form expressions of the resistance, capacitance, inductance, and conductance for intertie 3-D visa are presented.

What is optical characterization techniques?

The optical properties of a material can tell us important information about its physical properties, such as thickness. However, they can also reveal valuable information about the electronic properties of a material through the use of spectroscopy. Ellipsometry. Optical spectroscopy.

What are the different types of optical analysis?

Overall, four types of optical analyses, namely, fluorescence, colorimetry, chemiluminescence, and SERS, have been used to design amphenicol apt sensors. Each optical analysis method holds its own unique characteristics.

What is absorption X-ray?

In X-ray absorbance, sample atoms absorb X-rays from the source and the wavelength of the absorbed X-ray (usually recorded as the X-rays' energy) and the intensity of that absorbance provide the identity of that absorbing atoms and the concentration, respectively.

How X-rays are used for materials characterization?

X-ray characterization techniques include: High-resolution X-ray diffraction (XRD) for crystal structure, particle size determination, and phase composition; Scanning X-ray fluorescence (XRF) microscopy for determination of the local chemical composition of bulk powders, as well as of catalyst-coated membranes (CCM)

What does the absorption of X-rays in a given material follow?

The general law of X-ray absorption is therefore as follows: $\mu\alpha = kN^2\lambda^3 + \sigma a$ where k is a universal constant equal to 2.29×10^{-27} below the k limit and to 0.33×10^{-27} above that limit.

Which factor determines how materials absorb X-rays?

The absorption of X-rays by a tissue depends on the quality of the X-ray beam, the character of the atoms in the tissue being examined as well as the density and thickness of this tissue. The amount of X-ray absorption by the tissues defines the density of the shadow cast on the radiograph.

What is acoustic material?

Acoustical materials are a variety of foams, fabrics, metals, etc. used to quiet workplaces, homes, automobiles, and so forth to increase the comfort and safety of their inhabitants by reducing noise generated both inside and outside of those spaces.

What are acoustic properties of materials ?

Acoustical properties are the properties of materials that determine how they interact with sound. The acoustic properties of a building are based on the acoustic nature of that building's materials and how sound is transmitted through the adjacent structural elements.

What are the different types of acoustic sources?

Acoustic sources in the fluid environment are divided into four types: monopole, dipole, longitudinal quadrupole, and lateral quadrupole, which are also known as acoustic multi-poles.

How many types of acoustic are there?

There are different kinds of acoustics. They include environmental noise, musical acoustics, ultrasounds, infrasounds, vibration and dynamics.

Which material is best for acoustic?

Best Soundproofing Material

- Soundproofing Spray Foam. Definition: Foam sprayed from a can that can be added as insulation to walls for insulation. ...
- Mass Loaded Vinyl Sound Barrier. Definition: Heavy, versatile material that reduces noise wherever it is placed. ...
- Acoustic Caulk. ...
- Acoustic Window Inserts.

What is the new acoustic material?

The acoustic metamaterial created by the researchers is made of rubber and a mix of iron nanoparticles. The rubber offers flexibility, allowing the materials to bend and flex reversibly and repeatedly, while the iron makes the material responsive to the magnetic field.

What is ultrasonic evaluation of materials?

Ultrasonic testing (UT) comprises a range of non-destructive testing (NDT) techniques that send ultrasonic waves through an object or material. These high frequency sound waves are transmitted into materials to characterise the material or for flaw detecting.

What is the characteristic of ultrasonic sound?

Property 1: Ultrasonic waves vibrate at a frequency greater than the audible range for humans (20 kilohertz). Property 2: They have smaller wavelengths. As a result, their penetrating power is high. Property 3: They cannot travel through vacuum.

Which type of material is used in ultrasonic measurement?

Some ultrasonic coating thickness gauges require that a couplant in gel, paste or liquid format be used to eliminate gaps between the transducer and the test piece. One common couplant is propylene glycol, but there are many other options which can be substituted.