

1. Record Nr.	UNINA9910144728903321
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Titolo	Mossbauer effect in lattice dynamics [[electronic resource]] : experimental techniques and applications // Yi-Long Chen and De-Ping Yang
Pubbl/distr/stampa	Weinheim, : Wiley-VCH [Chichester, : John Wiley, distributor], c2007
ISBN	1-281-08804-8 9786611088040 3-527-61142-8 3-527-61143-6
Descrizione fisica	1 online resource (427 p.)
Altri autori (Persone)	YangDe-Ping
Disciplina	530.411 537.5352
Soggetti	Lattice dynamics Mossbauer effect Mossbauer spectroscopy Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Mossbauer Effect in Lattice Dynamics; Contents; Preface; 1 The Mossbauer Effect; 1.1 Resonant Scattering of γ -Rays; 1.2 The Mossbauer Effect; 1.2.1 Compensation for Recoil Energy; 1.2.2 The Discovery of the Mossbauer Effect; 1.3 The Mossbauer Spectrum; 1.3.1 The Measurement of a Mossbauer Spectrum; 1.3.2 The Shape and Intensity of a Spectral Line; 1.4 The Classical Theory; 1.5 The Quantum Theory; 1.5.1 Coherent States of a Harmonic Oscillator; 1.5.2 Gamma Radiation from a Bound Nucleus; 1.5.3 Mossbauer Effect in a Solid; 1.5.4 Average Energy Transferred; References; 2 Hyperfine Interactions 2.1 Electric Monopole Interaction 2.1.1 A General Description; 2.1.2 The Isomer Shift; 2.1.3 Calibration of Isomer Shift; 2.1.4 Isomer Shift and Electronic Structure; 2.2 Electric Quadrupole Interaction; 2.2.1 Electric Quadrupole Splitting; 2.2.2 The Electric Field Gradient (EFG); 2.2.2.1 Sources of EFG; 2.2.2.2 Temperature Effect on EFG; 2.2.3 Intensities of

the Spectral Lines; 2.2.4 The Sign of EFG; 2.3 Magnetic Dipole Interaction; 2.3.1 Magnetic Splitting; 2.3.2 Relative Line Intensities; 2.3.3 Effective Magnetic Field; 2.4 Combined Quadrupole and Magnetic Interactions

2.5 Polarization of γ -Radiation 2.5.1 Polarized Mossbauer Sources; 2.5.2 Absorption of Polarized γ -Rays; 2.6 Saturation Effect in the Presence of Hyperfine Splittings; 2.7 Mossbauer Spectroscopy; References; 3 Experimental Techniques; 3.1 The Mossbauer Spectrometer; 3.2 Radiation Sources; 3.3 The Absorber; 3.3.1 Estimation of the Optimal Thickness; 3.3.2 Sample Preparation; 3.4 Detection and Recording Systems; 3.4.1 Gas Proportional Counters; 3.4.2 NaI(Tl) Scintillation Counters; 3.4.3 Semiconductor Detectors; 3.4.4 Reduction and Correction of Background Counts; 3.4.5 Geometric Conditions

3.4.6 Recording Systems 3.5 Velocity Drive System; 3.5.1 Velocity Transducer; 3.5.2 Waveform Generator; 3.5.3 Drive Circuit and Feedback Circuit; 3.5.4 Velocity Calibration; 3.5.4.1 Secondary Standard Calibration; 3.5.4.2 Absolute Velocity Calibration; 3.6 Data Analysis; 3.6.1 Fitting Individual Lorentzian Lines; 3.6.1.1 Spectra from Crystalline Samples; 3.6.1.2 Spectra from Amorphous Samples; 3.6.2 Full Hamiltonian Site Fitting; 3.6.3 Fitting Thick Absorber Spectra; References; 4 The Basics of Lattice Dynamics; 4.1 Harmonic Vibrations; 4.1.1 Adiabatic Approximation

4.1.2 Harmonic Approximation 4.1.3 Force Constants and Their Properties; 4.1.4 Normal Coordinates; 4.2 Lattice Vibrations; 4.2.1 Dynamical Matrix; 4.2.2 Reciprocal Lattice and the Brillouin Zones; 4.2.2.1 Reciprocal Lattice; 4.2.2.2 Brillouin Zones; 4.2.3 The Born-von Karman Boundary Condition; 4.2.4 Acoustic and Optical Branches; 4.2.5 Longitudinal and Transverse Waves; 4.2.6 Models of Interatomic Forces in Solids; 4.3 Quantization of Vibrations: The Phonons; 4.4 Frequency Distribution and Thermodynamic Properties; 4.4.1 The Lattice Heat Capacity; 4.4.2 The Density of States

4.4.2.1 The Einstein Model

Sommario/riassunto

This up-to-date review closes an important gap in the literature by providing a comprehensive description of the Mossbauer effect in lattice dynamics, along with a collection of applications in metals, alloys, amorphous solids, molecular crystals, thin films, and nanocrystals. It is the first to systematically compare Mossbauer spectroscopy using synchrotron radiation to conventional Mossbauer spectroscopy, discussing in detail its advantages and capabilities, backed by the latest theoretical developments and experimental examples. Intended as a self-contained volume that may be used as a c