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1.9.3. X-ray absorption spectroscopy under extreme pressure and/or temperature conditions; 1.10. Conclusion; 1.11. Bibliography; Chapter 2. Nanoparticle Characterization using Central X-ray Diffraction; 2.1. Introduction; 2.2. Definition of scattered intensity; 2.3. Invariance principle; 2.3.1. General case; 2.3.2. Isotropic systems; 2.3.3. Multi-level systems; 2.4. Behavior for large  $q$ : the Porod regime; 2.5. Particle-based systems; 2.5.1. Definition of form factor; 2.5.2. Introduction to the structure factor; 2.5.3. Intensity behavior at small  $q$ : the Guinier regime; 2.5.4. Volume measurements; 2.5.5. Some well-known form factors; 2.5.6. Polyhedral particles; 2.5.6.1. Form factor of a polyhedron; 2.5.6.2. Comparison between different polyhedra with cylindrical and spherical forms; 2.6. An absolute scale for measuring particle numbers; 2.7. Conclusion; 2.8. Bibliography; Chapter 3. X-ray Diffraction for Structural Studies of Carbon Nanotubes and their Insertion Compounds; 3.1. Introduction; 3.1.1. Introduction to carbon nanotubes; 3.1.2. Uses of X-ray scattering for studies of carbon nanotubes; 3.2. Single-walled carbon nanotubes; 3.2.1. Calculation of a powder diffraction diagram; 3.2.1.1. Individual nanotubes; 3.2.1.2. Bundle structure; 3.2.1.3. Inclusion of a distribution of nanotube diameters; 3.2.1.4. Effects of nanotube length; 3.2.2. Analysis of experimental scattering diagrams; 3.3. Multi-walled carbon nanotubes; 3.3.1. Calculation of powder diffraction diagrams for a powder of individual multi-walled nanotubes; 3.3.2. Analysis of an experimental diffraction diagram; 3.4. Hybrid nanotubes; 3.4.1. Peapods; 3.4.2. Ion insertion into nanotubes; 3.5. Textured powder samples; 3.5.1. Quantification of nanotube orientation; 3.5.2. Separation of diffraction components in hybrid nanotubes

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## Sommario/riassunto

This book presents reviews of various aspects of radiation/matter interactions, be these instrumental developments, the application of the study of the interaction of X-rays and materials to a particular scientific field, or specific methodological approaches. The overall aim of the book is to provide reference summaries for a range of specific subject areas within a pedagogical framework. Each chapter is written by an author who is well known within their field and who has delivered an invited lecture on their subject area as part of the "RX2009 - X-rays and Materials" colloqui

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