

|                         |  |
|-------------------------|--|
| 1. Record Nr.           | UNINA9910821880203321  |
| Titolo                  | Computational approaches to energy materials / / edited by Richard Catlow, Aron Walsh, Alexey A. Sokol   |
| Pubbl/distr/stampa      | Chichester, West Sussex, United Kingdom, : John Wiley & Sons Inc., 2013  |
| ISBN                    | 9781118551462<br>111855146X<br>9781118551448<br>1118551443<br>9781299465251<br>1299465250<br>9781118551455<br>1118551451   |
| Edizione                | [1st ed.]  |
| Descrizione fisica      | 1 online resource (320 p.)   |
| Classificazione         | SCI013050  |
| Altri autori (Persone)  | CatlowC. R. A <1947-> (Charles Richard Arthur)<br>WalshAron<br>SokolAlexey A   |
| Disciplina              | 621.31   |
| Soggetti                | Energy storage - Mathematical models<br>Electron distribution - Mathematical models<br>Energy conversion - Mathematical models   |
| 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       | Computational Approaches to Energy Materials; Contents; About the Editors; List of Contributors; Preface; Acknowledgments; 1 Computational Techniques; 1.1 Introduction; 1.2 Atomistic Simulations; 1.2.1 Basic Concepts; 1.2.2 Parameterization; 1.2.3 Parameter Sets; 1.2.4 Implementation; 1.3 Electronic Structure Techniques; 1.3.1 Wavefunction Methods; 1.3.1.1 Hartree-Fock Theory; 1.3.1.2 Post-Hartree-Fock Approaches; 1.3.1.3 Semi-empirical Wavefunction Methods; 1.3.2 Density Functional Theory; 1.3.2.1 Exchange-Correlation Functionals; 1.3.2.2 Semi-empirical Density Functional Approaches |

1.3.3 Excited States1.4 Multiscale Approaches; 1.4.1 Hybrid QM/MM Embedding Techniques; 1.4.2 Beyond Atomistic Models; 1.5 Boundary Conditions; 1.6 Point-Defect Simulations; 1.6.1 Mott-Littleton Approach; 1.6.2 Periodic Supercell Approach; 1.7 Summary; References; 2 Energy Generation: Solar Energy; 2.1 Thin-Film Photovoltaics; 2.2 First-Principles Methods for Electronic Excitations; 2.2.1 Hedin's Equations and the GW Approximation; 2.2.2 Hybrid Functionals; 2.2.3 Bethe-Salpeter Equation; 2.2.4 Model Kernels for TDDFT; 2.3 Examples of Applications; 2.3.1 Cu-Based Thin-Film Absorbers  
2.3.2 Delafossite Transparent Conductive Oxides2.4 Conclusions; References; 3 Energy Generation: Nuclear Energy; 3.1 Introduction; 3.2 Radiation Effects in Nuclear Materials; 3.2.1 Fission; 3.2.1.1 Structural Materials; 3.2.1.2 Fuel; 3.2.1.3 Cladding; 3.2.2 Fusion; 3.2.2.1 Structural Materials; 3.2.2.2 Plasma-Facing Materials; 3.2.3 Waste Disposal; 3.3 Modeling Radiation Effects; 3.3.1 BCA Modeling; 3.3.2 Molecular Dynamics; 3.3.2.1 Cascade Simulations; 3.3.2.2 Sputtering Simulations; 3.3.3 Monte Carlo Simulations; 3.3.3.1 Kinetic Monte Carlo; 3.3.3.2 Object Kinetic Monte Carlo  
3.3.3.3 Transition Rates3.3.3.4 Examples; 3.3.4 Cluster Dynamics; 3.3.4.1 Examples; 3.3.4.2 Comparison with OKMC; 3.3.5 Density Functional Theory; 3.3.5.1 Interatomic Potentials; 3.3.5.2 Transition Rates; 3.4 Summary and Outlook; References; 4 Energy Storage: Rechargeable Lithium Batteries; 4.1 Introduction; 4.2 Overview of Computational Approaches; 4.3 Li-Ion Batteries; 4.4 Cell Voltages and Structural Phase Stability; 4.5 Li-Ion Diffusion and Defect Properties; 4.6 Surfaces and Morphology; 4.7 Current Trends and Future Directions; 4.8 Concluding Remarks; References  
5 Energy Storage: Hydrogen5.1 Introduction; 5.2 Computational Approach in Hydrogen Storage Research; 5.3 Chemisorption Approach; 5.4 Physisorption Approach; 5.5 Spillover Approach; 5.6 Kubas-Type Approach; 5.7 Conclusion; References; 6 Energy Conversion: Solid Oxide Fuel Cells; 6.1 Introduction; 6.2 Computational Details; 6.3 Cathode Materials and Reactions; 6.3.1 Surfaces: LaMnO<sub>3</sub> and (La,Sr) MnO<sub>3</sub> Perovskites; 6.3.1.1 Surface Termination, Surface Point Defects; 6.3.1.2 Oxygen Adsorption and Diffusion; 6.3.1.3 Rate-Determining Step of the Surface Reaction  
6.3.2 Bulk Properties of Multicomponent Perovskites

---

#### Sommario/riassunto

"Outlining their strengths, limitations, contemporary, and future applications, Computational Approaches to Energy Materials is the first authoritative resource to present a broad survey of computational techniques for the development of energy materials. Printed in full color to aid interpretation of materials simulations, this accessible and much-needed text includes all current methodologies based on electronic structure, interatomic potential, and hybrid methods. The methodological components are integrated into a comprehensive survey of applications, addressing the major themes in energy research"--

"This authoritative but accessible text is the first book on the market presenting a broad survey of computational techniques for the development of energy materials, outlining their strengths, limitations, contemporary and future applications"--

---