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Autore	Zhang Jin Z
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Chalcogenides; 3.2.5 Conclusion; 3.3 Photoelectrochemical Methods; 3.3.1 Background; 3.3.2 Photocathode for Water Reduction; 3.3.3 Photoanode for Water Oxidation 3.3.4 Conclusion 3.4 Summary; References; 4: Biohydrogen Generation and Other Methods; 4.1 Basics about Biohydrogen; 4.2 Pathways of Biohydrogen Production from Biomass; 4.3 Thermochemical Conversion of Biomass to Hydrogen; 4.3.1 Hydrogen from Biomass via Pyrolysis; 4.3.2 Hydrogen from Biomass via Gasification; 4.3.3 Hydrogen from Biomass via Supercritical Water (Fluid-Gas) Extraction; 4.3.4 Comparison of Thermochemical Processes; 4.4 Biological Process for Hydrogen Production; 4.4.1 Biophotolysis of Water Using Microalgae; 4.4.2 Photofermentation; 4.4.3 Dark Fermentation 4.4.4 Two-Stage Process: Integration of Dark and Photofermentation 4.5 Summary; References; 5: Established Methods Based on Compression and Cryogenics; 5.1 Basic Issues about Hydrogen Storage; 5.2 High Pressure Compression; 5.3 Liquid Hydrogen; 5.4 Summary; References; 6: Chemical Storage Based on Metal Hydrides and Hydrocarbons; 6.1 Basics on Hydrogen Storage of Metal Hydrides; 6.2 Hydrogen Storage Characteristics of Metal Hydrides; 6.2.1 Storage Capacities; 6.2.2 Thermodynamics and Reversible Storage Capacity; 6.2.3 Hydrogenation and Dehydrogenation Kinetics; 6.2.4 Cycling Stability 6.2.5 Activation 6.3 Different Metal Hydrides; 6.3.1 Binary Metal Hydrides; 6.3.2 Metal Alloy Hydrides; 6.3.3 Complex Metal Hydrides; 6.3.4 Improving Metal Hydride Performance; 6.4 Hydrocarbons for Hydrogen Storage; 6.4.1 Reaction between Carbon Atom and Hydrogen; 6.4.2 Reaction between Solid Carbon and Hydrogen; 6.4.3 Reaction between Carbon Dioxide and Hydrogen; 6.5 Summary; References; 7: Physical Storage Using Nanostructured and Porous Materials; 7.1 Physical Storage Using Nanostructures; 7.1.1 Carbon Nanostructures; 7.1.2 Other Nanostructures and Microstructures 7.2 Physical Storage Using Metal-Organic Frameworks

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## Sommario/riassunto

Addresses the three fundamental aspects of hydrogen as a fuel resource: generation, storage, and utilization Provides theoretical basis for the chemical processes required for hydrogen generation, including solar, photoelectrochemical, thermochemical, and fermentation methods Discusses storage of hydrogen based on metal hydrides, hydrocarbons, high pressure compression, and cryogenics Examines the applications of hydrogen utilization in the fields of petroleum, chemical, metallurgical, physics, and manufacturing Contains over 90 figures, including 27 col

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