

1. Record Nr.	UNINA9910484824803321
Titolo	Metal-organic frameworks in biomedical and environmental field // Patricia Horcajada Cortes, Sara Rojas Macias, editors
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2021] ©2021
ISBN	3-030-63380-2
Descrizione fisica	1 online resource (xiii, 503 pages) : illustrations
Disciplina	547.05
Soggetti	Metal-organic frameworks
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- Contents -- Contributors -- Chapter 1: Robust and Environmentally Friendly MOFs -- 1.1 Introduction -- 1.2 Stability of Metal-Organic Frameworks -- 1.2.1 Chemical Stability -- 1.2.1.1 Reinforcing the Coordination Bond -- 1.2.1.2 Preserving the Coordination Bond -- 1.2.2 Thermal Stability -- 1.2.3 Mechanical Stability -- 1.3 Environmentally Friendly MOFs -- 1.3.1 Chemicals -- 1.3.1.1 Metal-Ion Precursors -- 1.3.1.2 Linkers -- 1.3.1.3 Solvent -- 1.3.1.4 Additives -- 1.3.2 Synthesis and Purification Processes -- 1.3.2.1 Synthesis Process -- 1.3.2.2 Purification Processes -- 1.4 Concluding Remarks -- References -- Chapter 2: Large-Scale Synthesis and Shaping of Metal-Organic Frameworks -- 2.1 Introduction -- 2.2 Scale-Up Synthesis of MOFs -- 2.2.1 Batch-Type Production -- 2.2.2 Continuous-Flow Production of MOFs -- 2.3 Shaping of MOF -- 2.3.1 Conventional Methods of Powder Shaping (Fig. 2.6) -- 2.3.1.1 Granulation -- 2.3.1.2 Extrusion -- 2.3.1.3 Pressing -- 2.3.2 Solidifying Methods -- 2.3.2.1 Spray-Drying -- 2.3.2.2 Foaming -- 2.3.2.3 Alginate -- 2.4 Summary -- References -- Chapter 3: Green Energy Generation Using Metal-Organic Frameworks -- 3.1 General Introduction -- 3.2 Initial Considerations -- 3.2.1 Parameters Affecting Photocatalysis -- 3.2.1.1 Surface Area Effect -- 3.2.1.2 Active Cluster -- 3.2.1.3 Light Absorption -- 3.2.1.4 Excitation Lifetime/Rate-Determining Step -- 3.2.1.5 Sacrificial Agents -- 3.2.2 Parameters Affecting Electrocatalysis -- 3.2.2.1 Catalytic Activity of the Reaction

Site -- 3.2.2.2 Intrinsic Conductivity of the Material -- 3.2.2.3 Electrical Contact to the Current Collector/CP-Collector Interface -- 3.3 Photocatalysis -- 3.3.1 Hydrogen Evolution Reaction -- 3.3.2 Oxygen Evolution Reaction -- 3.4 Electrocatalysis -- 3.4.1 Hydrogen Evolution Reaction -- 3.4.1.1 Acidic Medium -- 3.4.1.2 Alkaline Medium. 3.4.2 Oxygen Evolution Reaction -- 3.4.2.1 Alkaline Medium -- 3.4.2.2 Neutral Medium -- 3.4.3 Oxygen Reduction Reaction -- 3.4.3.1 Alkaline Medium -- 3.4.3.2 Neutral Medium -- 3.4.3.3 Acidic Medium -- 3.5 Conclusions and Perspectives -- References -- Chapter 4: The Potential of MOFs in the Field of Electrochemical Energy Storage -- 4.1 Introduction -- 4.1.1 Batteries and Supercapacitors: Definitions, Basic Principles, and Characteristics -- 4.1.2 Devices -- 4.2 MOF as Active Materials -- 4.2.1 High-Potential Materials: Insertion Mechanism -- 4.2.2 Low-Potential Materials: Conversion and Alloying -- 4.2.3 Combining Organic and Inorganic Redox Activity: From Redox-Active Core to Non-innocent Ligands -- 4.3 MOFs as Host for Active Species -- 4.3.1 Organic Molecules -- 4.3.2 Sulfur -- 4.4 MOFs for as Coatings of Active Materials -- 4.4.1 Coating on Cathode Materials -- 4.4.2 Coating on Anode Materials -- 4.5 MOF-Based Separators -- 4.5.1 Separator for Li-Ion and Li-Metal Batteries -- 4.5.2 Separators for Emerging Battery Technologies -- 4.6 MOFs as Solid Electrolytes -- 4.7 Conclusion and Prospects -- References -- Chapter 5: Carbon Capture Using Metal-Organic Frameworks -- 5.1 Introduction -- 5.2 Targets for Carbon Capture: CO₂-Containing Gas Streams -- 5.2.1 Power Generation -- 5.2.2 Natural Gas and Biogas Upgrading -- 5.3 Solid Adsorbents -- 5.3.1 Fundamentals of Adsorption and Separation over Solid Adsorbents -- 5.3.2 Pressure and Temperature Swing Adsorption on Solid Adsorbents -- 5.3.3 Selectivity of Adsorption -- 5.4 MOFs as Adsorbents for Carbon Capture by PSA and TSA -- 5.4.1 Background -- 5.4.2 Precombustion Gas Streams -- 5.4.3 Post-combustion Carbon Capture -- 5.4.3.1 Background -- 5.4.3.2 Physisorption Approaches -- 5.4.3.3 Chemisorption Approaches -- 5.4.4 Air Capture: Ultramicroporous and Biomimetic MOFs. 5.4.5 Biogas and Natural Gas Upgrading -- 5.4.6 Summary of MOFs as Solid Adsorbents for Carbon Capture -- 5.5 MOFs as Fillers for Mixed Matrix Membranes -- 5.5.1 Introduction -- 5.5.2 Fundamentals of Gas Transport Through Membranes -- 5.5.2.1 Mechanism -- 5.5.2.2 Robeson Plots -- 5.5.2.3 Testing Membranes -- 5.5.3 MOF-Based Mixed Matrix Membranes -- 5.5.3.1 Introduction -- 5.5.3.2 Polymer Choice -- 5.5.3.3 Choice of MOF Fillers -- 5.5.3.4 Interface Engineering and Textural Optimisation -- 5.5.4 Summary of Mixed Matrix Membrane Performance -- 5.5.5 Towards Industrial Application: Hollow Fibre Membranes -- 5.5.6 Summary -- 5.6 A Word on CO₂ Utilisation -- 5.7 Conclusions -- References -- Chapter 6: Computational Screening of MOFs for CO₂ Capture -- 6.1 Introduction -- 6.2 Molecular Simulations of MOFs for CO₂ Capture -- 6.2.1 Identifying Structural Properties of MOFs -- 6.2.2 Computing CO₂ Adsorption in MOFs -- 6.2.3 Calculating CO₂ Separation Performances of MOFs -- 6.3 Large-Scale Molecular Simulations of MOFs for CO₂ Capture -- 6.3.1 Refining MOF Databases -- 6.3.2 Screening of MOFs -- 6.4 Role of QSPR and Machine Learning in Screening of MOFs for CO₂ Capture -- 6.5 Conclusions and Outlook -- References -- Chapter 7: Water Purification: Removal of Heavy Metals Using Metal-Organic Frameworks (MOFs) -- 7.1 Heavy Metals -- 7.1.1 Sources of Heavy Metals in Water -- 7.1.2 Effects on Health -- 7.2 MOFs for Removal of Heavy Metals from Water -- 7.2.1 Mercury -- 7.2.2 Lead -- 7.2.3 Cadmium -- 7.3 Summary -- References -- Chapter 8: Adsorptive Purification of Water Contaminated with Hazardous Organics by Using

Functionalized Metal-Organic Frameworks -- 8.1 Introduction -- 8.2 Discussion -- 8.2.1 Introduction to Functionalized MOFs -- 8.2.2 Mechanism of Adsorptive Purification -- 8.2.2.1 Electrostatic Interaction -- 8.2.2.2 H-Bonding Interaction. -- 8.2.2.3 Pi-Interactions -- 8.2.2.4 Other Mechanisms -- 8.2.3 Contribution of Functional Groups on Adsorption -- 8.2.3.1 Functional Group of -NH₂ or -NH- -- 8.2.3.2 Functional Group of -OH -- 8.2.3.3 Functional Group of -COOH -- 8.2.3.4 Functional Group of -SO₃H -- 8.2.3.5 Other Functional Groups -- 8.3 Conclusions and Perspective -- References -- Chapter 9: MOFs Constructed from Biomolecular Building Blocks -- 9.1 Introduction -- 9.2 Nucleobases -- 9.2.1 Discrete Complexes and 1-D Polymers -- 9.2.2 Purine-Based Bio-MOFs -- 9.2.3 Purine-Based Bio-MOFs with Secondary Linkers -- 9.3 Amino Acids, Peptides, and Proteins -- 9.3.1 Amino Acids -- 9.3.2 Small Peptides and Secondary Linkers -- 9.3.3 Functionalized Peptides -- 9.3.4 Proteins -- 9.4 Saccharides -- 9.4.1 Bio-MOFs Constructed from Simple Sugars -- 9.4.2 Cyclodextrin Bio-MOFs -- 9.5 Conclusions and Future Outlook -- References -- Chapter 10: Natural Polymer-Based MOF Composites -- 10.1 Introduction -- 10.2 Processing Methodologies -- 10.2.1 Electrospinning -- 10.2.2 Hot-Pressing Method -- 10.2.3 Biomimetic Biomineralization -- 10.2.4 Layer-by-Layer Deposition -- 10.3 Natural Polymer-MOF Composites -- 10.3.1 Cellulose-Based Composites -- 10.3.1.1 Cellulose Nanofiber-Based Composites -- 10.3.1.2 Cellulose Aerogel-Based Composites -- 10.3.2 Cotton-Based Composites -- 10.3.3 Pulp (Paper)-Based Composites -- 10.3.4 Silk-Based Composites -- 10.3.5 Chitosan- and Chitin-Based Composites -- 10.4 Conclusion, Outlook, and Future Perspective -- References -- Chapter 11: Metal-Organic Frameworks as Delivery Systems of Small Drugs and Biological Gases -- 11.1 An Ideal Drug Delivery System -- 11.2 Metal-Organic Frameworks as Drug Delivery Systems -- 11.3 The Importance of Material Selection -- 11.4 The Control of Small Molecule Drug Release -- 11.5 Metal-Organic Frameworks as Delivery Systems for Biological Gases. -- 11.6 The Intracellular Fate of MOFs -- 11.7 External Surface Chemistry -- 11.8 Current Challenges -- 11.9 Outlook -- References -- Chapter 12: MOFs and Biomacromolecules for Biomedical Applications -- 12.1 Introduction -- 12.2 Synthesis Methods -- 12.2.1 Surface Immobilization -- 12.2.1.1 Adsorption of Biomacromolecules on MOFs -- 12.2.1.2 Grafting of Biomacromolecules on MOFs -- 12.2.1.3 General Considerations for Biomacromolecules-On-MOF Composites -- 12.2.2 Embedding of Biomacromolecules in MOFs -- 12.2.2.1 Infiltration -- 12.2.2.2 Encapsulation -- Influence of the Biomacromolecule Surface Chemistry on the Encapsulation Process -- The Relative Size of Biomacromolecules and MOF Pores -- Influence of the Chemical Properties of the MOF on the Encapsulation Process -- Influence of Coprecipitation Agents on the Encapsulation Process -- Crystalline Phase of Biomacromolecules@ZIF-8 -- Recent Developments of Encapsulation Synthetic Protocols -- General Considerations on Biomacromolecules@MOF Composites Obtained Via Encapsulation -- 12.2.3 General Properties of MOFs Biocomposites -- 12.2.3.1 Controlled MOF Degradation and Cargo Release -- 12.2.3.2 MOF Biocompatibility -- Biocomposite Particle Size -- 12.3 Applications of Biomacromolecules and MOF Biocomposites -- 12.3.1 Protein@MOF as Drug Delivery Systems -- 12.3.2 Protein@MOFs for Biopreservation -- 12.3.3 Protein-On-MOFs and Proteins@MOFs Biocomposites in Assays -- 12.3.3.1 Applications of Protein@MOF Biocomposites for Small Molecule Detection -- Protein@MOF as H₂O₂ Sensors -- Protein@MOF as Glucose Sensors -- 12.3.3.2 Protein-On-MOFs and Proteins@MOFs

Biocomposites in Immunoassays -- 12.3.4 Carbohydrates@MOF and Carbohydrates-On-MOF Biocomposites as Drug Delivery Systems --
12.3.4.1 MOFs as Carriers for CH-Based Therapeutics -- 12.3.4.2 Carbohydrates-On-MOF Biocomposites for DDS.
12.3.5 Nucleic Acid and MOF Biocomposites.
