

1. Record Nr.	UNINA9910784547403321
Autore	Barbir Frano <1954->
Titolo	PEM fuel cells [[electronic resource] ] : theory and practice // Franco Barbir
Pubbl/distr/stampa	Amsterdam ; ; Boston, : Elsevier Academic Press, 2005
ISBN	1-280-63044-2 9786610630448 0-08-045541-7
Descrizione fisica	1 online resource (448 p.)
Collana	Academic Press sustainable world series
Disciplina	621.312429
Soggetti	Fuel cells Ion-permeable membranes
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	Foreword; Preface and Acknowledgments; Chapter 1: Introduction; 1.1. What Is a Fuel Cell?; 1.2. A Very Brief History of Fuel Cells; 1.3. Types of Fuel Cells; 1.4. How Does a PEM Fuel Cell Work?; 1.5. Why Do We Need Fuel Cells?; 1.6. Fuel Cell Applications; References; Chapter 2: Fuel Cell Basic Chemistry and Thermodynamics; 2.1. Basic Reactions; 2.2. Heat of Reaction; 2.3. Higher and Lower Heating Value of Hydrogen; 2.4. Theoretical Electrical Work; 2.5. Theoretical Fuel Cell Potential; 2.6. Effect of Temperature; 2.7. Theoretical Fuel Cell Efficiency; 2.8. Carnot Efficiency Myth 2.9. Effect of Pressure 2.10. Summary; References; Problems; Quiz; Chapter 3: Fuel Cell Electrochemistry; 3.1. Electrode Kinetics; 3.1.1. Reaction Rate; 3.1.2. Reaction Constants; Transfer Coefficient; 3.1.3. Current Potential Relationship-Butler-Volmer Equation; 3.1.4. Exchange Current Density; 3.2. Voltage Losses; 3.2.1. Activation Polarization; 3.2.2. Internal Currents and Crossover Losses; 3.2.3. Ohmic (Resistive) Losses; 3.2.4. Concentration Polarization; 3.3. Cell Potential-Polarization Curve; 3.4. Distribution of Potential Across A Fuel Cell 3.5. Sensitivity of Parameters in Polarization Curve 3.5.1. Effect of Transfer Coefficient/Tafel Slope; 3.5.2. Effect of Exchange Current Density; 3.5.3. Effect of Hydrogen Crossover and Internal Current Loss; 3.5.4. Effect of Internal Resistance; 3.5.5. Effect of Limiting Current

Density; 3.5.6. Effect of Operating Pressure; 3.5.7. Air vs Oxygen; 3.5.8. Effect of Operating Temperature; 3.6. Fuel Cell Efficiency; 3.7. Implications and Use of Fuel Cell Polarization Curve; 3.7.1. Other Curves Resulting from Polarization Curve; 3.7.2. Linear Approximation of Polarization Curve; 3.7.3. Use of Polarization Curve for Fuel Cell Sizing; References; Problems; Quiz; Chapter 4: Main Cell Components, Materials Properties and Processes; 4.1. Cell Description; 4.2. Membrane; 4.2.1. Water Uptake; 4.2.2. Physical Properties; 4.2.3. Protonic Conductivity; 4.2.4. Water Transport; 4.2.5. Gas Permeation; 4.3. Electrode; 4.4. Gas Diffusion Layer; 4.4.1. Treatments and Coatings; 4.4.2. Porosity; 4.4.3. Electrical Conductivity; 4.4.4. Compressibility; 4.4.5. Permeability; 4.5. Bipolar Plates; 4.5.1. Materials; 4.5.2. Properties; References; Problems; Quiz; Chapter 5: Fuel Cell Operating Conditions; 5.1. Operating Pressure; 5.2. Operating Temperature; 5.3. Reactants Flow Rates; 5.4. Reactants Humidity; 5.5. Fuel Cell Mass Balance; 5.5.1. Inlet Flow Rates; 5.5.2. Outlet Flow Rates; 5.6. Fuel Cell Energy Balance; References; Problems; Quiz; Chapter 6: Stack Design; 6.1. Sizing of a Fuel Cell Stack; 6.2. Stack Configuration; 6.3. Uniform Distribution of Reactants to Each Cell; 6.4. Uniform Distribution of Reactants Inside Each Cell; 6.4.1. Shape of the Flow Field; 6.4.2. Flow Field Orientation; 6.4.3. Configuration of Channels; 6.4.4. Channel's Shape, Dimensions, and Spacing

---

## Sommario/riassunto

Fuel cells are electrochemical energy conversion devices that convert hydrogen and oxygen into water, producing electricity and heat in the process and providing fuel efficiency and reductions in pollutants. Demand for this technology is growing rapidly. Fuel cells are being commercialized for stationary and portable electricity generation, and as a replacement for internal combustion engines in automobiles. Proton Exchange Membrane (PEM) fuel cells in particular are experiencing an upsurge. They have high power density and can vary their output quickly to meet shifts in power demand.

---