

# Contents

<b>1</b>	<b>Introduction to Gas Transport in Solid Oxide Fuel Cells</b> . . . . .	1
1.1	Introduction to SOFCs . . . . .	1
1.1.1	Brief History of SOFC Development . . . . .	1
1.1.2	Principles of SOFCs . . . . .	2
1.1.3	Energy Losses in SOFCs . . . . .	4
1.2	Gas Transport in SOFCs . . . . .	6
1.2.1	General Consideration . . . . .	6
1.2.2	The Driving Force of Gas Diffusion in Electrodes—Concentration Gradient . . . . .	7
1.2.3	Gas Transport in the Porous Electrodes . . . . .	7
	References . . . . .	8
<b>2</b>	<b>Gas Diffusion Mechanisms and Models</b> . . . . .	9
2.1	Gas Diffusion in Porous Media . . . . .	9
2.1.1	General Consideration . . . . .	9
2.1.2	Molecular Diffusion . . . . .	10
2.1.3	Knudsen Diffusion . . . . .	11
2.2	Gas Diffusion in Porous Electrodes of Solid Oxide Fuel Cells . . . . .	14
2.2.1	Advective–Diffusive Model . . . . .	14
2.2.2	Maxwell–Stefan Model . . . . .	14
2.2.3	Dusty Gas Model . . . . .	15
2.2.4	Effective Gas Diffusion Model . . . . .	16
	References . . . . .	16
<b>3</b>	<b>Diffusivity Measurement Techniques</b> . . . . .	19
3.1	Diffusivity Measurement in Porous Media . . . . .	19
3.2	Advanced Diffusivity Measurement Techniques in Solid Oxide Fuel Cells . . . . .	22

- 3.3 The Role of Advanced Diffusivity Measurement Techniques in Exploring Highly Efficient Solid Oxide Fuel Cell Electrodes . . . . . 27
  - 3.3.1 Correlations Between the Diffusivity and Concentration Polarization. . . . . 27
  - 3.3.2 Correlations Between Concentration Polarization and Structures of Anodes/Cathodes . . . . . 29
- 3.4 Quantity Analysis of Measurement Error of the Diffusivity and Concentration Polarization . . . . . 31
  - 3.4.1 Current Error . . . . . 31
  - 3.4.2 Pressure Error. . . . . 36
  - 3.4.3 Temperature Error . . . . . 39
- References . . . . . 42
  
- 4 Solid Oxide Fuel Cells with Improved Gas Transport. . . . . 45**
  - 4.1 Introduction . . . . . 45
  - 4.2 Brief Review of SOFC Electrode Materials. . . . . 46
  - 4.3 Synthesis Methodology for Microstructure Control of SOFC Electrodes . . . . . 48
  - 4.4 Characterization Techniques of Microstructures of SOFC Electrodes . . . . . 51
  - 4.5 Correlations between Electrode Microstructures and SOFC Mass Transport . . . . . 53
    - 4.5.1 I–V Curve Fitting . . . . . 54
    - 4.5.2 Electrochemical Impedance Spectra . . . . . 60
    - 4.5.3 Theoretical Simulations . . . . . 63
  - 4.6 Summary . . . . . 64
  - References. . . . . 65
  
- 5 Conclusions and Trajectories for the Future . . . . . 71**
  
- Index. . . . . 75**



<http://www.springer.com/978-3-319-09736-7>

Gas Transport in Solid Oxide Fuel Cells

He, W.; Lv, W.; Dickerson, J.

2014, XIV, 75 p. 47 illus., 41 illus. in color., Softcover

ISBN: 978-3-319-09736-7