



Ahmet Evren Firat (Autor)

Mechanical Analysis of PEM Fuel Cell Stack Design



<https://cuvillier.de/de/shop/publications/7247>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>



Table of Contents

Nomenclature

Abstract

1	<i>Motivation</i>	1
2	<i>Introduction</i>	3
2.1	Fuel Cell Applications	3
2.1.1	Stationary Applications	3
2.1.2	Portable and Transportation Applications	4
2.2	Theoretical Background	5
2.2.1	Type of Fuel Cells	5
2.2.2	Thermodynamics of PEM Fuel Cells	5
2.2.3	Operating Principles of PEM Fuel Cells	6
2.2.4	Electrochemistry of Fuel Cells	8
2.2.5	Operating Conditions of PEM Fuel Cells	10
2.3	Fuel Cell Stack	11
2.3.1	ZBT Fuel Cell Stack Design	12
2.3.2	PEM Fuel Cell Stack Components	13
3	<i>Cell and Stack Tests</i>	19
3.1	Measuring the Thermal Expansion of the Fuel Cell Stack.....	19
3.1.1	Operating Conditions and Measurements.....	22
3.2	Pressure Films	31
3.3	Cell Performance.....	33
4	<i>Fuel Cell Modeling</i>	35
4.1	Introduction to Finite Element Method	37
4.2	Fuel Cell Stack Simulations (Stack-Size).....	43
4.2.1	Literature Model Overview	43
4.2.2	Model Development	44
4.2.3	Results and Evaluation	54
4.3	Fuel Cell Simulations (Cross-Section Model)	69
4.3.1	Literature Model Overview	69
4.3.2	Model Development	70
4.3.3	Results and Evaluation	87
5	<i>Conclusions and Outlook</i>	99
6	<i>References</i>	103
7	<i>List of Figures</i>	113
8	<i>List of Tables</i>	115