

# Preface

Summarizing the initial 10 years of research and development in the field of microfluidic fuel cell and battery technology for electrochemical energy conversion and storage, this SpringerBrief is the first book dedicated to this emerging field. Written at a critical juncture, where strategically applied research is urgently required to seize impending technology opportunities for commercial, analytical, and educational utility, this book is a comprehensive resource for current and prospective researchers in the general area of membraneless, microfluidic electrochemical energy conversion.

I have been active in this field since 2005, when I joined the University of Victoria as a Ph.D. student, inspired by the notion of a low-cost fuel cell without membrane or catalyst. My initial research endeavors culminated in a Ph.D. dissertation entitled “Microfluidic fuel cells” [1], which was subsequently awarded with the Governor General’s Gold Medal and launched my career as a researcher and scholar. Since 2009, I have continued my research on microfluidic fuel cells as a faculty member at Simon Fraser University (SFU), where I established the SFU Fuel Cell Research Laboratory (FCReL) and expanded the scope of this research to include microfluidic redox flow batteries.

Since the goal of the book is to provide a comprehensive resource for both research and technology developments, it features extensive descriptions of the underlying fundamental theory, fabrication methods, and cell design principles, as well as a thorough review of previous contributions in this field and a concluding chapter with recommendations for further work. It builds substantially on information collected over the last 10 years and draws specifically on our previously published review articles in *Journal of Power Sources* [2] and *Biomicrofluidics* [3] and book chapter in *Micro Fuel Cells: Principles and Applications* [4], as well as a recent review manuscript on co-laminar flow cells for electrochemical energy conversion [5]. It is hoped that this book will enable new research groups to develop the next generation of microfluidic electrochemical cells.

I wish to express my sincere gratitude to everyone who has contributed either directly or indirectly to the publication of this book. In particular, I wish to thank my former supervisors at the University of Victoria, Dr. David Sinton, Dr. Ned Djilali, and Dr. David Harrington. I thank all current and past SFU FCReL students who have participated in our microfluidic fuel cell and battery projects, especially Marc-Antoni Goulet and Dr. Jin Wook Lee who have had leading roles over the past several years and generated major advances in this field and including, but not limited to, Bernard Ho, Deepak Krishnamurthy, Erik Johansson, Xiaoye Liang, Jun Hong, Omar Ibrahim, Aronne Habisch, Dean Chen, Spencer Arbour, Jeetinder Ghataurah, Chris de Torres, Stephan Rayner, Jeffrey To, Nader Moradi, David Afonso, Dan Latuszek, Larry Hoang, Peter Hsiao, Sandeep Sanghera, and Christopher Stewart.

This research was supported by the Natural Sciences and Engineering Research Council of Canada, Western Economic Diversification Canada, Canada Foundation for Innovation, British Columbia Knowledge Development Fund, and Simon Fraser University.

Surrey, BC, Canada

Erik Kjeang

## References

1. E. Kjeang, *Microfluidic Fuel Cells*, PhD Dissertation, University of Victoria, 2007
2. E. Kjeang, N. Djilali, D. Sinton, Microfluidic fuel cells: a review. *J. Power Sources.* **186**, 353–369 (2009)
3. J.W. Lee, E. Kjeang, A perspective on microfluidic biofuel cells. *Biomicrofluidics.* **4**, 041301 (2010)
4. E. Kjeang, N. Djilali, D. Sinton, Advances in microfluidic fuel cells, in *Micro Fuel Cells: Principles and Applications*, ed. by T.S. Zhao (Elsevier B.V., 2009). ISBN: 978-0-12-374713-6
5. M.A. Goulet, E. Kjeang, Co-laminar flow cells for electrochemical energy conversion. *J. Power Sources.* **260**, 186–196 (2014)



<http://www.springer.com/978-3-319-06345-4>

Microfluidic Fuel Cells and Batteries

Kjeang, E.

2014, X, 76 p. 17 illus. in color., Softcover

ISBN: 978-3-319-06345-4