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Series C: Environmental Security
Mini-Micro Fuel Cells

Fundamentals and Applications

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PREFACE

This volume contains an archival record of the NATO Advanced Institute on Mini – Micro Fuel Cells – Fundamental and Applications held in Çesme – Izmir, Turkey, July 22–August 3, 2007. The ASIs are intended to be a high-level teaching activity in scientific and technical areas of current concern. In this volume, the reader may find interesting chapters on Mini-Micro Fuel Cells with fundamentals and applications. In recent years, fuel-cell development, modeling and performance analysis has received much attention due to their potential for distributed power which is a critical issue for energy security and the environmental protection. Small fuel cells for portable applications are important for the security. The portable devices (many electronic and wireless) operated by fuel cells for providing all-day power, are very valuable for the security, for defense and in the war against terrorism.

Many companies in NATO and non-NATO countries have concentrated to promote the fuel cell industry. Many universities with industrial partners committed to the idea of working together to develop fuel cells. As technology advanced in the 1980s and beyond, many government organizations joined in spending money on fuel-cell research. In recent years, interest in using fuel cells to power portable electronic devices and other small equipment (cell phones, mobile phones, lab-tops, they are used as micro power source in biological applications) has increased partly due to the promise of fuel cells having higher energy density. In developing these smaller fuel cell systems, one cannot simply use scaled-down system architectures and components used in their larger counterparts. Small fuel cell systems may be divided into portable fuel cells (>100 W), miniature fuel cells (10–100 W) and micro fuel cells (0–10 W). These types of mini/micro fuel cells importance are evident for security in the war against terror. This volume on Mini-Micro Fuel Cells as Electric Energy Generators provides a comprehensive state-of-the-art assessment of this technology by treating the subject in considerable depth through lectures from eminent professionals in the field, discussions, and panel sessions. Main lectures will include Fuel cell basic electrochemistry and thermodynamics, Design concepts of micro-mini fuel cells, Fundamental merit parameters of micro fuel cells and barriers to meeting target values for such parameters, Direct methanol fuel cell
technology platforms for micro fuel cell applications, Electrocatalysis state of the art in methanol fuel cells and possible future directions, Fundamental comparison of high temperature vs. low temperature micro/miniature fuel cells, Durability of micro/miniature fuel cells, Accelerated characterization and life prediction of micro/miniature fuel cells, Dynamic characteristic of 30 W class DMFC system for notebook PC, Design and preparation of micro fuel cell using for DNB phone, Principal of direct methanol fuel cell for portable and micro power, Computational modelling of two-phase transport in portable and micro fuel cells, Current state of R&D on micro tubular solid oxide fuel cells in Japan, Toho’s solid oxide fuel cells from material to systems, Micro-tubular SOFC systems, Mechanical properties and modeling of micro-tubes used in SOFC systems, Intermediate-temperature Solid oxide fuel cell systems used for APU units, Analysis and principals of methanol reformers for Fuel cells, The easy test concept, Autonomous test units for mini membrane assemblies, PEM systems for special applications, Heat pipe concept in fuel cell technology and others. During the ten working days of the Institute, the invited lecturers covered fundamentals and applications of Mini – Micro Fuel Cells. The sponsorship of the NATO Scientific Affairs Division is gratefully acknowledged; in person, we are very thankful to Dr. Fausto Pedrazzini director of ASI programs and his executive secretary Alison Trapp who continuously supported and encouraged us at every phase of our organization of this Institute. We are also very grateful to Annelies Kersbergen publishing editor of Springer Science; our special gratitude goes to Drs. Nilufer Egrican, Hafit Yuncu, Sepnem Tavman, Almila Yazicioglu, Tuba Okutucu, Ahmet Yozgatligil, Derek Baker and Gratiela Tarlea for coordinating sessions and we are very thankful to Basar Bulut and Ertan Agar for their very valuable help for smooth running the Institute with the assistant secretary Cahit Koksal.

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