

Preface

Fuel cell technology is quite promising for conversion of chemical energy of hydrocarbon fuels into electricity without forming air pollutants. There are several types of fuel cells: polymer electrolyte fuel cell (PEFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC), solid oxide fuel cell (SOFC), and alkaline fuel cell (AFC). Among these, SOFCs are the most efficient and have various advantages such as flexibility in fuel, high reliability, simple balance of plant (BOP), and a long history. Therefore, SOFC technology is attracting much attention as a power plant and is now close to marketing as a combined heat and power generation system. From the beginning of SOFC development, many perovskite oxides have been used for SOFC components; for example, LaMnO_3 -based oxide for the cathode and LaCrO_3 for the interconnect are the most well known materials for SOFCs. The current SOFCs operate at temperatures higher than 1073 K. However, lowering the operating temperature of SOFCs is an important goal for further SOFC development. Reliability, durability, and stability of the SOFCs could be greatly improved by decreasing their operating temperature. In addition, a lower operating temperature is also beneficial for shortening the startup time and decreasing energy loss from heat radiation. For this purpose, faster oxide ion conductors are required to replace the conventional Y_2O_3 -stabilized ZrO_2 electrolyte. A new class of electrolytes such as LaGaO_3 is considered to be highly useful for intermediate-temperature SOFCs.

Although a number of books on fuel cells have been published, a book focused on the materials aspects of SOFCs is not yet available. This book provides comprehensive and up-to-date information on the properties and performance of perovskite oxides for SOFCs. Individual chapters have been written by internationally renowned researchers in their respective fields. The book is primarily intended for use by researchers, engineers, managers, and other technical people working in the field of SOFCs. Also, the information contained in most of the chapters is fundamental enough for the book to be useful even as a text for a SOFC technology course at the graduate level. I hope that this book is able to contribute to the development of SOFCs from the material aspects. At present, global warming and the energy crisis are the most

serious problems for sustained development of human society. I believe that SOFC technology would contribute in solving these issues.

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Tatsumi Ishihara



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