

Preface

Energy is on everyone's mind these days because of the expanding need for electricity, lighting, heating, cooling, and transportation fuels. Finding more efficient ways to produce energy is a global priority. In addition, the production of energy needs to be sustainable and clean. At the core of the energy infrastructure is the need for materials for energy conversion, energy storage, and energy distribution.

The focus of this book is on ways to synthesize, assemble, and modify materials that find use in systems designed for energy conversion and energy storage. The sol-gel process has been used for a variety of systems that serve the energy market. The singular advantage of the sol-gel process is its being a low-temperature route to simple and complex oxide materials. Low-temperature processing allows the combination of organic and inorganic materials, such as hybrid membranes and ion conductors. Another advantage of the sol-gel process is that it begins in liquid form, so that it is easily adapted to coatings and surface treatments, such as electrochromic windows and multilayer thin film stacks. Furthermore, the sol-gel process leads to high surface area materials and porous materials, meaning it has applications in catalysis, environmental remediation, and carbon dioxide sequestration.

Through the lens of sol-gel processing, this book is about the selection and preparation of materials for batteries, fuel cells, photovoltaics, thermoelectrics, energy harvesting ferroelectrics, and supercapacitors. The properties of these materials are explored in detail. Their applications and performance are described and evaluated. The interested reader can gain a sense of the state of the art and, at the same time, the need for further improvement.

Since new solutions are needed to solve the problem of increasing energy consumption, it would bring the co-editors great satisfaction if this book motivates some or all of its readers to double their efforts toward finding new ways to use the sol-gel process to address materials, needs. The co-editors wish to thank Mike Luby of Springer for his encouragement to take on this project. Merry Stuber is thanked for her editorial assistance. This project would not have come together if it were not for the outstanding response from the chapter authors and their wonderful

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On behalf of my co-editors, Mario Aparicio and Andrei Jitianu,

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