

Preface

Concern has grown in recent decades about energy consumption and environmental impact. This is the reason why governments all over the world are heavily investing in R&D in energy and environment. As a result, the labor market will require more and more manpower with extensive and in-depth knowledge in energy. This creates an unprecedented opportunity for graduates of Materials Science and Engineering. In schools or departments in universities around the world, the proportion of courses regarding energy harvesting and storage has been significantly increased. Common courses include solar cells, lithium-ion batteries, and supercapacitors. However, waste energy harvesting is rarely found as a course for students in departments of materials science and engineering, although all the related materials have been included in other courses in one way or another.

As a result, two years ago, we proposed to open a new course, Waste Energy Harvesting, for year-three and year-four undergraduate students, in the School of Materials Science and Engineering, Nanyang Technological University. The purpose was to instill the students with more application-oriented knowledge on materials science and engineering, focusing on waste energy harvesting. While we drafted the syllabus, we tried to find a textbook as reference, but we found that there were no books with similar names and contents covering all topics of interest. Therefore, we decided to compile a book based on the outline we proposed for the above-mentioned course.

This book consists of six chapters, with the first chapter serving as an *Introduction* and [Chaps. 2–6](#) each for one type of energy harvesting and related materials. [Chapters 2](#) and [3](#) deal with waste mechanical energy harvesting by using piezoelectric effect, while [Chaps. 4–6](#) cater to waste thermal energy (heat) harvesting. The five chapters follow a similar structure that is aimed to demonstrate interrelationships among principle, materials, processing/fabrication, performance (enhancement strategies), and applications. Therefore, it can be used as textbook or reference book for senior undergraduate and postgraduate students in materials science and engineering, as well as students of other disciplines, such as

applied physics, chemical engineering, electric and electronic engineering, mechanical engineering, and so on, who are involved in materials-related research or training. It also can be a reference book for engineers and scientists in R&D of energy materials and applications.

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Mechanical and Thermal Energies

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