

Preface

We owe our children similar chances as we had when we started exploiting the resources the earth is offering us. This does not mean that we should not use what the earth provides. It neither implies that we should not change the earth's appearance. Exactly that is the aspiration of humankind. However, to allow this quest to grow also in future generations, we have to act in what we call a sustainable way. One huge impact on the (non-) sustainability of current human actions is related to the supply of energy for nowadays' society. The large-scale exploitation of fossil and nuclear resources conflicts with the idea of sustainability, as those resources were generated during millions or even billions of years. Their rapid consumption depletes them quickly and causes global changes which might be too rapid to be coped with by humankind in a fair way. Regarding energy "consumption", the most sustainable way of living is to harvest the energy flux continuously provided by the sun.

This book describes the fundamentals regarding the conversion of solar energy into electricity. It focuses on a relatively novel type of solar cell based on organic materials, where the term "organic" refers to molecules based on hydrocarbons, which are synthesized in the framework of organic chemistry. These solar cells show many advantages and peculiarities compared to their inorganic counterparts. Organic photovoltaics covers and combines three interesting, important, and challenging fields: basic theory of solar energy conversion, materials science on novel semiconductors, and physics and technology applied to the energy sector.

With this book I aim to address a broad readership with background in electrical engineering, physics, or materials science. The book should provide students in those fields with a solid introduction and a broad overview of organic photovoltaics. The main focus of the book is on the device physics and working principle of organic solar cells. The textbook-like character of several chapters makes the book also valuable for readers from other disciplines like chemistry or mathematics.

Apart from students searching for introductions, professionals in the field are addressed as well. This book offers parallel to the didactic part a comprehensive discussion of the state of the art. It studies questions of general interest using modeling and experimental data. However, these parts are not organized in a

reporting way but rather an explanatory way. In general, intuitive approaches are preferred to rigorous derivations in case of very complex problems. Note that it is not the scope of this book to give a complete review of the literature regarding organic solar cells.

The prevailing book is based on my Ph.D. thesis, however, faced a complete revision. Especially the introductory parts are strongly extended to give them very general textbook-like characteristics. The second part is reorganized and new data are added. I want to thank all the individuals mentioned in the acknowledgments of my thesis without explicitly repeating the text here. I wrote the book while working as a researcher in the groups of Prof. Dr. Karl Leo and Prof. Dr. Olle Inganäs, who are acknowledged for the freedom they gave me. Moreover I want to thank Ivan Ramirez, Prof. Dr. Horst Hartmann, Dr. Koen Vandewal, Dr. Feng Gao, Johannes Widmer, and Armantas Melianas for inspiring discussions regarding parts of the book. Prof. David Haviland, Torben Menke, Beatrice Beyer, Christian Körner, Selina Olthof, Dr. Lars Müller-Meskamp, Martin Hermenau, and Dr. Mingtao Lu are acknowledged for reading and commenting on sections of the book. I thank Jonas Bergqvist and Dr. Mattias Andersson for comments on the last chapter, Dr. Scott Maugers, Prof. Dr. Sean Shaheen, Dr. Bertrand Tremolet de Villers, and Dr. David Paul Ostrowski for carefully reading the manuscript and detecting inconsistencies and language mistakes. I kindly acknowledge support by the Reiner-Lemoine foundation during my Ph.D. work, the BMBF (Germany), and the Wallenberg foundation (Sweden).

I hope that this book will be of use for many people who want to understand how organic solar cells work. Multiplied by the brains and hands of those, I am sure that this book will contribute to the efforts toward a sustainable energy supply.

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