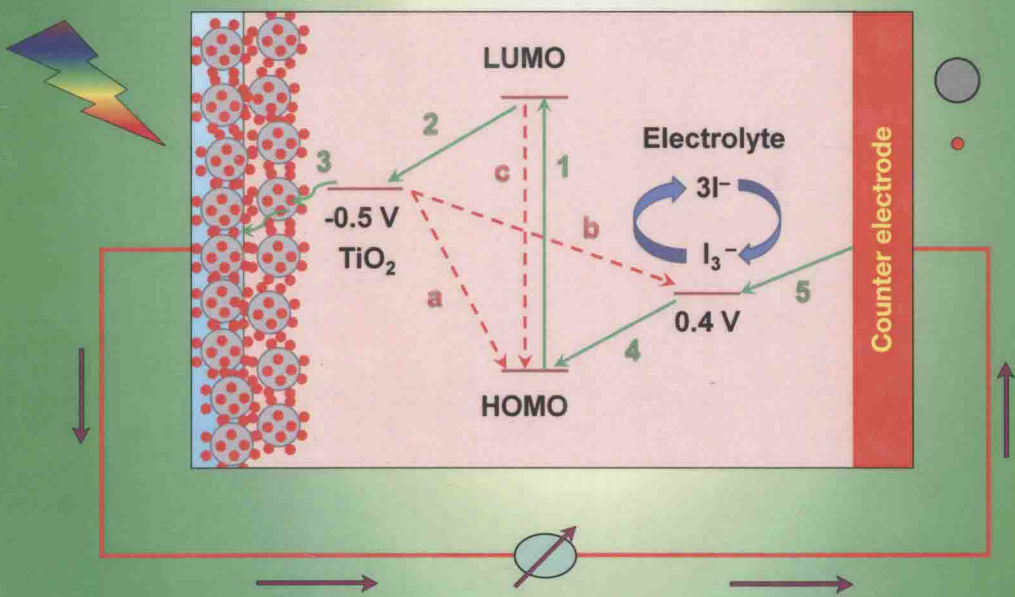
Solar Cell Nanotechnology



Edited by
Atul Tiwari • Rabah Boukherroub • Maheshwar Sharon

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Preface

Developments in human civilization have revolved around the consumption of energy. Historically, control over energy has been directly related to the centralization of power. The natural abundance of fossil fuels has helped sovereign nations in gaining better control over sociological developments. The absence of such natural resources has forced the remaining societies to greatly depend on the lucky ones that have them. In some cases, the developments have slowed to a crawl, and even basic needs have not been fulfilled. Therefore, materials scientists and engineers have taken up the challenge to reduce our dependence on fossil fuel resources. The invention of methods to harness solar energy has given new hope to the nations with limited or no fossil fuel reserves. In the last few decades the idea of technologies based on solar cells has been well established. New techniques of materials synthesis and their integration in novel engineering designs have helped the industry produce solar cells with high energy efficiency. The use of high purity silicon has dominated the solar cell industry for several decades. It appears that the efficiency of silicon-based solar cells has achieved maximum potential and no further improvements are expected. The high cost of extra pure silicon and saturation in energy efficiency has motivated scientists to look for new materials and technologies that are efficient and relatively cost effective.

Journals are flooded with research articles with claims about materials and technologies that might be able to produce highly efficient solar cells. It is therefore important to summarize the literature in order to draw meaningful conclusions based on the latest research findings. Since silicon-based solar cells are immensely popular, various books are available on the subject. It was therefore decided to look at other types of solar cells, which are either in the development phase or are likely competitors of silicon solar cells.

The purpose of our efforts has been to collect articles from various experts in the field with this view in mind. This book is composed of seventeen chapters, each of which was written by an expert in their field. Topics are broadly designed to cover dye-sensitized types of solar cells and their related problems, layered types of solar cells, application of lithography in solar cells, and luminescent solar and plasmonic light trapping. Graphene being the most recent discovery, its application in organic types of solar cells is covered in this book. Finally, analytical modeling and electrical circuit design, which are another important aspect of solar cell development, are also included. The final section of the book appends to the series of articles written on putative future trends in this area. This section is specifically written for advanced practitioners to help them channel their expertise in the desired direction.

We expect that readers will gain an in-depth knowledge in new areas of solar cells, which are not commonly known and for which literature is scarcely available. This title has been edited for a broad readership that includes scholars and researchers from diverse backgrounds, and for commercial sectors looking for innovative solar cell materials and related technologies. This could be a solitary reference book for researchers in materials science, engineering and nanotechnology. We are confident that readers will gain invaluable information that can be utilized not only in research and development, but also in commercial manufacturing of solar cell panels.

Atul Tiwari, PhD
Rabah Boukherroub, PhD
Maheshwar Sharon, PhD

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