

Preface

Although long known that temperature negatively affects the performances of PV devices, research and engineering in photovoltaics has been mainly focused on reducing the optical and electrical losses. This book is the result of several years of research dedicated to understand better the thermal behavior of photovoltaic devices. The work on this topic was triggered by simple questions such as: Why does temperature negatively affect the efficiency of most photovoltaic systems? Is it possible to engineer the temperature sensitivities of solar cells? If it is not possible to make their performance completely independent of temperature, what can be done to minimize their operating temperatures?

In this book, we discuss the different temperature-driven phenomena that are important in the field of photovoltaics. We provide detailed physics-based explanations of the mechanisms involved and review different solutions and strategies to mitigate the temperature-induced losses. The original perspective we have taken in this book to describe the fundamental principles of photovoltaic conversion has its origins in the diversity of our backgrounds. Throughout the book, we introduce a novel approach to optimize the design of photovoltaic devices where thermal criteria are integrated. Because the thermal behavior of a photovoltaic system is deeply intertwined with its electrical and optical/radiative characteristics, the optimum set of design parameters is always a function of the operating conditions, which depend on the location and the mounting configuration of the system. This means that photovoltaic devices can be designed to maximize their energy yield in specific conditions (climates, installations, etc.). The present book provides models and concepts to guide researchers and engineers towards the development of this kind of optimization that goes beyond the standard test conditions.

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