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Faculty of Fundamental Problems of Technology
Quantum Engineering

BACHELOR'S THESIS

Type III solar cells based on quantum dots

Maksymilian Kliczkowski

Wrocław, data

Abstract

In this thesis the extensive study of possible and surly optimal materials for Quantum Dot Solar Cells (QDSCs) will be provided to the reader. One will have the opportunity to develop a rather current image of the necessary parts in their architecture which will be supported with an abundant description of the important aspects in engineering a photovoltaic device. With an introduction of its kind we will try to convey a basic but sufficient knowledge of standard terms, light with matter interaction, light spectrum analysis, quantum dots description with their behaviour and a photovoltaic device operation theory with certainly needed quantities that one has to find in order to properly describe a solar cell. In many parts we will try to outline possible enlargement of that information. With the objective of creating a possibly competitive QDSC the description of methods that we used will be included with a related to them characteristics. One will also be able to use this paper as a review of today's development phase and current technological state of the other scientific groups all around the world. After a successful development of a solar cell the analyse and comparison will definitely be provided.

Contents

Introduction

We, as a society nowadays, are in constant demand for energy. Although, even with the development of calculating, conducting and studying it, we don't really know what the energy is, we are depending on that abstract quantity. One might probably say that to study physics is to endure to study energy in its every possible form. There's a brilliant quote from Bill Bryson that: "Energy is liberated matter, matter is energy waiting to happen." What might be incredible is that from this strictly mathematical quantity we can deduct anything. And what's also important it is as arbitrary as it gets, depending only on one's reference. From energy we can create few more important quantities such as power P, which is simply the energy provided per unit time, so:

E= $\int P\,(t)\,dt$

The energy will be represented in J (Joules) or eV (electron volt), which directly describes energy of elementary charge body ($e \approx 1.602 * 10^{-19} C$) in 1V (Volt) potential.

1eV=1.602*$10^{-19} J$

Power will be then represented in W (Watts)($W = Js$).

The rise of energy consumption has proven that in the future we will almost certainly require even more. From Global Energy Perspective paper $\mathrm{GrindEQ}_{1\,we can learn that:}$

enumerate

G lobal energy demand will reach plateau at around 2035 despite strong population expansion and economic growth thanks to emphasis on renewable sources, more efficient service industries or more efficient industrial regions

T he energy demand and economic growth became "decoupled" for the first time in history

R enewables will provide more than half the electricity after 2035