CHAPTER I

INTRODUCTION

A solar cell is a photovoltaic device which can convert radiant energy into electrical energy with high overall efficiency. They have played an important role in space program for nearly two decades. There are over 500 satellites of various types in an orbit around the earth powered by silicon solar cells[1]. The world is currently facing an energy crisis due to oil shortage. To alleviate this burden, considerable attention have been focussed to solar cells to be used for terrestrial applications such as photovoltaic power generators.

Thailand, like other developing countries, is facing the same situation. The Thai governmental agencies have also paid their attention to solar energy, as an alternative source of energy. Thailand is located in a region where considerable benefit could be gained immediately from the widespread ultilization of solar energy. Hence, photovoltaic solar cell technology could be suitable to her via "appropriate technology"[2] of which some actual applications are telecommunication, portable power generator for agricultural applications, other applications in isolated area and TV network for educational purposes.

This thesis is concerned with an analysis of photocurrent in a silicon n-on-p junction solar cell. Increase of photocurrent in n-on-p silicon solar cells is achieved by varying some parameters, such as, the junction depth , X_j, the substrate resistivity, ρ_b, the front surface recombination velocity, S_p, dead layer, δ and the back surface

recombination velocity, S_n. The experimental results show higher photocurrent under the conditions of the shallowest x_j, the high ρ_b, elimination of δ , and the Back Surface Field effect.

The numerical simulation of photocurrent to predict the increasing trends of the photocurrent by varying the values of the above parameters. To verify the numerical calculation, various groups of solar cells were fabricated and tested accordingly.

Chapter II summarizes the general basic theory of solar cell characteristics. Fundamental principle of photovoltaic energy conversion is briefly discussed first. Then, the last section of this chapter summarises the relationship between electrical characteristics and internal structure of n-on-p junction solar cells.

Chapter III considers the relevant model of photocurrent in an n-on-p silicon solar cell and the effects of variations in geometrical and physical parameters of this model in order to see the increasing trends of photocurrents. A computer program in the FORTRAN IV language is written to simulate the model and to study the trend.

Chapter IV deals with the fabrication of various groups of solar cells.

Discussion of the results and conclusions are presented in chapter V and VI respectively.