

**IMPACT OF THICKNESS AND MATERIAL OPTIMIZATION IN DOUBLE-
LAYER ANTIREFLECTION COATINGS (DLARCs) ON THE
PERFORMANCE OF SILICON SOLAR CELL USING PC1D SIMULATION**

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ABSTRACT

IMPACT OF THICKNESS AND MATERIAL OPTIMIZATION IN DOUBLE-LAYER ANTIREFLECTION COATINGS (DLARCs) ON THE PERFORMANCE OF SILICON SOLAR CELL USING PC1D SIMULATION

Surface reflection losses that restrict light absorption and lower total energy conversion and have a major impact on silicon photovoltaic (PV) cell efficiency. This study examines how double-layer antireflection coatings (DLARCs) affect silicon solar cells' performance by using numerical software through PC1D simulation. The impacts of different material pairings, such as TiO_2 as a top layer with the bottom layer which are SiO_2 , ZnO , Si_3N_4 , SiC , and ZnS , on PV performance parameters including I_{sc} , V_{oc} , FF, P_{max} and efficiency were analysed by modelling. With an efficiency of 24.265% at 500 nm, the simulation results show that the $\text{TiO}_2/\text{SiO}_2$ combination has the best antireflection performance. This research shows that solar cell efficiency can be increased and reflectance significantly decreased by optimising the thickness and refractive index of DLARCs. The results help advance sustainable energy technologies and encourage the adoption of simulation-based techniques for the low-cost design and optimisation of high-performance PV cells.

TABLE OF CONTENTS

	PAGE
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
ABSTRAK	v
TABLE OF CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS	x

CHAPTER 1 INTRODUCTION

1.1	Research background	1
1.2	Problem Statement	3
1.3	Research Questions	5
1.4	Objectives	5
1.5	Significance of study	5
1.6	Expected Output/Outcomes/Implication	6

CHAPTER 2 LITERATURE REVIEW

2.1	Introduction	8
2.2	Silicon Solar Cell	8
	2.2.1 Structure of Silicone Solar Cell	10
	2.2.2 Working Principle of Silicon Solar Cell	11
2.3	Parameter	12
2.4	PCID	13
2.5	Anti-reflecting coating (ARC)	14
	2.5.1 Double-layer Anti-reflecting coating (DLARC)	16
	2.5.2 ARC loss	17
2.6	I-V curve characteristics	21

CHAPTER 3 RESEARCH METHODOLOGY

3.1	Introduction	23
3.2	Flow chart of the study	24
3.3	PCID Software	25
3.4	Simulation by using PCID software	27

CHAPTER 4 RESULT AND DISCUSSION	
4.1 Introduction	32
4.2 Efficiency Comparison	33
4.3 I-V Characteristic of Silicon Solar Cell with Different DLARCs	40
 CHAPTER 5 CONCLUSION AND RECCOMENDATIONS	
5.1 Summary of Findings	42
5.2 Recommendations	43
 CITED REFERENCES	44
APPENDICES	48
<i>CURRICULUM VITAE</i>	55