Evolutionary Optimization of Absorption Enhancement in Ultrathin Cyrstalline Silicon Solar Cells with Tapered Nanohole Gratings

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Abstract

For silicon thin film, the light absorption enhancement is essential for improving ultimate effciency and thus decrease cost of materials. In this paper, we propose double sided grating structures with nanocone and nanohole, and the light enhancement is optimized with genetic algorithm. The optimal structure has...

Keyworkds: Nanocone, Nanohole, Absorption Enhancement, Photovoltica, Optimization

Introduction

Recenlty, designing crystalline silicon thin film solar cells with thickness of a few micrometers. Efficiency light absorption is essential for thin film solar cells, which requires broadband antireflection textures and light trapping structures. In the past years, various of silicon nanostructures, such as nanowires, nanocones, nanoholes, nanospheres, nanopyramids and so on, have been studied for antireflection coatings or light trapping extensively. In this

paper, we propose a double sided gratings structures so that we can optimize both the antireflection and light trapping. Nanohole and nanocone structures are used as textures with different combinations of parameters, after thorough simulations and optimization with genetic algorithm, we find out the optimal structure approaching the Yablonovitch limit. And also the effects of nanocone and nanohole are compared.

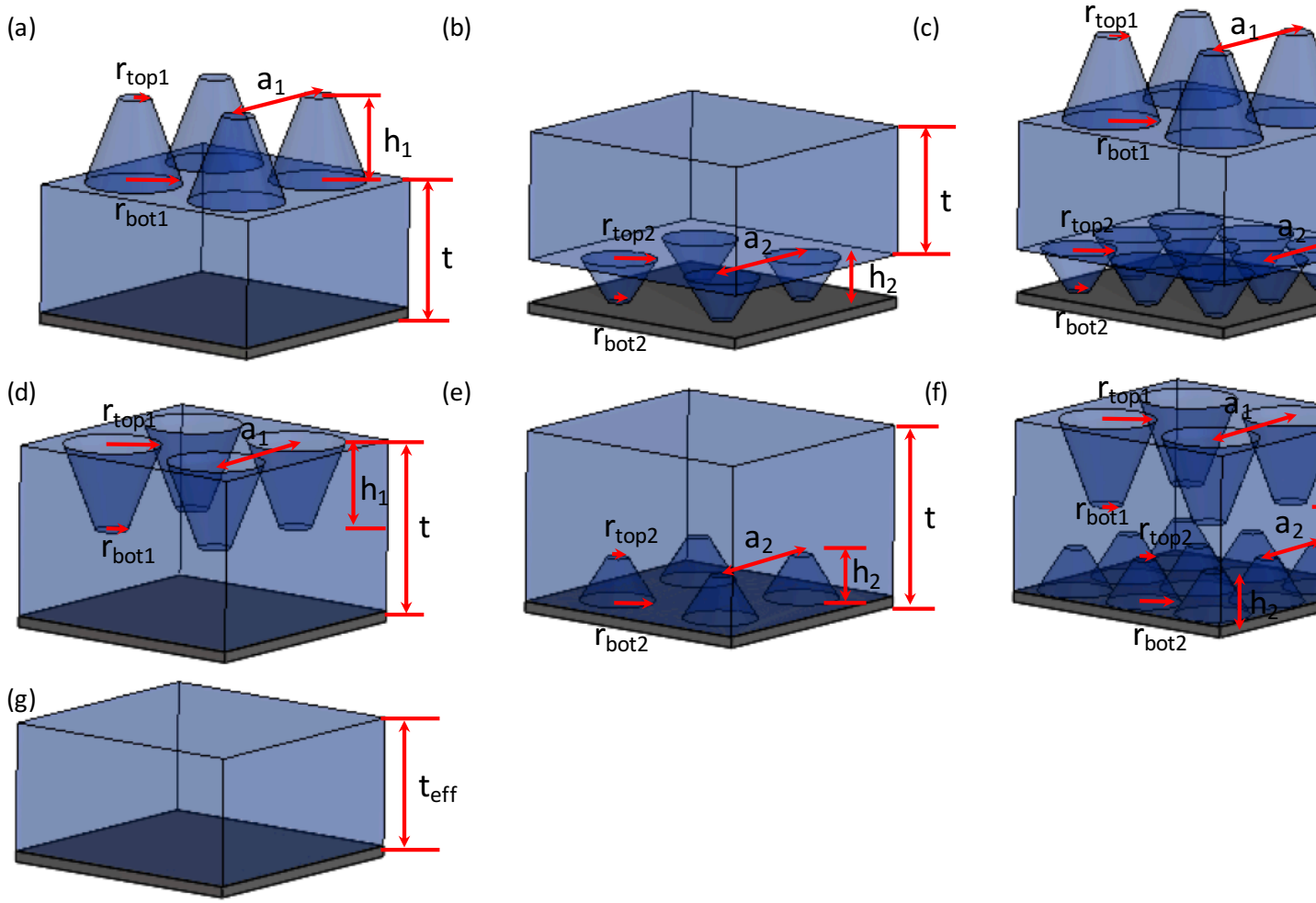

Figure 1: (Color online) (a) Vertical nanowires array schematic. (b) Contour plot of absorption as a function of photon wavelength and nanowire diameter for vertical Si nanowire arrays. The dash-dotted white lines indicate nanowires illustrated in (c). (c) Absorption spectrum of nanowires with $d = 70, 85$, and 120 nm for blue, green, and red photodetectors.

Results and discussion

Acknowledgement

Supporting Information Available

This material is available free of charge via the Internet at `http://pubs.acs.org/`.

Graphical TOC Entry