Thin Black Silicon Solar Cells

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INTRODUCTION

Solar power is an already well-established renewable energy type, which is used in many places globally. Commercial solar cells are typically made of silicon, due to the amount of knowledge concerning silicon semiconductor technology.
Even though scientific research has come up with many possible solutions for increased efficiency of solar cells, they are in general very complicated to fabricate, and as a consequence more expensive than conventional cells, rendering it impossible for such a solar cell to be competitive on the solar cell marked.
One way of making a competitive cell could be by material savings, and thereby being able to offer the same efficiency and power, for a lower price.
Today for solar cells, the largest expense in fabricating the cells is the silicon cost. This will for a 200 µm cell correspond to about 81 % of the total cost.
Our idea is to save material and cost of the solar cell by making the solar cells thinner, which will lead to less pollution due to the optimized use of silicon. By implementing the surface structuring known as black silicon for minimizing reflection, we at the same time expect to have a higher efficiency than conventional solar cells.
Conventional solar cells have a surface structure defined by a KOH etch, which etches as deep as 30-40µm. With the RIE black silicon etch we will at most etch 1 µm away, resulting in a significant material saving.
In the end, we expect to only use ¼ of the silicon used in conventional cells.

OUR PROJECT

Our project is our bachelor thesis, and concerns fabricating these special solar cells, as well as characterizing their electrical capabilities.
We want to test the efficiency of solar cells from 10 µm and up, however there is no effective manufacturing of silicon wafers this thin at this point. Hence, for our project, we will need to thin silicon wafers down to the desired thicknesses, in order to demonstrate the need for the thin wafers.
When finalized, the solar cells will be tested in a new measurement setup at DTU Nanotech, which is able to measure efficiency while changing the angle of incidence of the incoming light upon the solar cells.
The project falls into the ‘concept’ category.