Development of Robust Numerical Methods in Simulating High-Efficiency Energy-Saving Silicon Solar Cells

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Abstract

The objective of this proposal is to develop powerful mathematical tools that enable us to gain insight in the field of computational material sciences. More specifically, we are interested in numerical simulation of efficient crystalline silicon solar cells.

Recently, we have developed a new anti-reflection coating on silicon solar cell which has greatly increased the amount of light the solar cells can receive and reflected much less light than all other production coatings. It has a great potential in improving the efficiency of solar cells and saving more energy for our planet. In this project, we will utilize the new anti-reflection coating in designing high-efficiency silicon solar cells. In order to reduce the experimental cost and shorten the laboratory testing time of the whole discovery process, numerical modeling will be used in different aspects of solar cells, such as light transmission, interaction between light and electric current, and electric current flows.

The new solar cell is anticipated to achieve a higher efficiency than other silicon solar cells. All the valuable data obtained from this new cell will be used as exploring preliminary results for a solar energy proposal which will be submitted to NSF soon.

This research will also be incorporated into the education at Portland State University for both undergraduate and graduate students so that they will be able to learn how to apply mathematics in solving real world application problems efficiently.

Financial support of a graduate student assistant with 0.30 FTE stipend and a 9-credit tuition waiver for one term is requested. The student will help with setting up appropriate models to finish all simulation tasks in a timely fashion.