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Method and tool to reverse the charges in anti-reflection films used for solar cell applications

Anti-reflection coatings are used to improve light gathering in solar cells. The most common coating currently in use is made from hydrogenated silicon nitride. This coating develops a positive charge because of the charge on a silicon-nitrogen dangling bond, known as K centers. This charge creates a barrier layer that reduces surface recombination in the cell when n-type silicon is on the front side. However, when p-type silicon is used on the front side or when anti-reflective coating is used on the backside of a cell with p-type silicon, the coating causes parasitic shunting. This effect reduces the amount of electricity the cell can produce. It is anticipated that future solar cells will predominately have p-type silicon on the front side of the cell. In order to improve solar cell efficiency there is a need to develop coatings that do not have an adverse effect on energy production when used in conjunction with p-type silicon.

Researchers at Arizona State University have developed a process that reverses the charge in dielectric, silicon nitride films. This process uses corona charging to permanently fix the charge in the dielectric layer. The first step in the process is to apply a silicon oxide layer. This is followed by a plasma-enhanced chemical vapor deposition of nitride film. Then contacts are applied to the cell, which is followed by corona charging. Corona discharge is the final step of the process. Once the process is complete, the film provides excellent anti-reflective properties and creates a barrier layer that reduces surface recombination in the cell. The coating eliminates parasitic shunting and improves the efficiency of p-type silicon cells.

Potential Applications

- Solar cells
- Bi-facial solar cells
- Sensors
- Light emitting diodes

Benefits and Advantages

- Lower Costs – Solar cells provide more energy for the money
- More Power – Allows solar cells to be more efficient
- Retrofit – Process works with existing manufacturing processes

For more information about the inventor(s) and their research, please see Dr. Clarence Tracy's directory webpage