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Method of Forming Front Metallization for Solar Cells and Method and System for Fast Formation of Fine Metallization for Solar Cells

AzTE Case # M12-106P and M13-210P

Background

Modern silicon solar cell manufacturing relies on screen printing as a metallization process to apply the front contact grid to solar cells. This process uses silver-containing paste that is applied on top of the silicon nitride anti-reflection coating. In order for the paste to solidify and make contact to the substrate, the cell goes through a sequence of thermal treatments. At first the paste dries out then it etches through the dielectric, and finally makes contact with silicon. The screen printing process has a number of drawbacks, limiting potential improvement of future solar cells. Most advanced screen printing techniques do not allow less than 80 μm grid line width in mass production. Metallization this wide is not required for the collection of electrons, and it reduces cell performance by shading the cell. Another drawback is the mechanical pressure applied to the wafer during printing. New manufacturing techniques are allowing silicon wafers to become thinner. Using screen printing manufacturing processes to apply contact metallization causes damage to thin silicon wafers. Finally, because silver is expensive, manufacturers need cost effective alternative materials for front metallization.

Invention Description

Researchers at Arizona State University have developed a fast and inexpensive method for applying contact grids to solar cells. The process is applied in one step, eliminating a series of thermal treatments. No pressure is placed on the silicon wafers, thus preventing cell damage and improving the yield of high quality cells. In production application the grid metallization can be applied at a width of 30 μm , which reduces shading on the cell from the contacts. This process eliminates expensive materials such as silver. As the process is low temperature, the method can be used in applications that are sensitive to heating. With some modifications the process could be used in 3D printing manufacturing applications.

Potential Applications

- Solar cell contact grids
- Flexible displays
- 3D printing

Benefits and Advantages

- **Lower Costs** – Contact grids can be applied using copper, which is less expensive than silver.
- **More Power** – Conductive fingers are thinner and more conductive with less cell shading.
- **Retrofit** – Reduces manufacturing steps and eliminates production equipment.