

Eliminating Bowing of Thin Solar Cells through Brief Freezing

Field of Application

Solar cells are commonly manufactured from wafers which are between 270 and 330 μm thick. The manufacturing process involves the application of metal contacts and subsequent firing of these contacts. Because of the greater contraction of the aluminium rear contact relative to that of the silicon wafer during cooling after the firing, a tension is established that results in a permanent deformation of the solar cell. The magnitude of this deformation (bowing) depends mainly on the geometry of the wafer (thickness and size) and the quantity of aluminium that is being applied. A production objective is the use of thinner wafers to ensure optimal use of silicon which is a scarce resource.

Current State of Technology

Bowing of 1 to 1.5 mm is acceptable in the further processing steps combining the solar cells into modules. Trials with thinner wafers were carried out using different paste compositions and applying reduced quantities of paste. But this was only partially successful, resulting in reduced conversion efficiency, and is not suitable for very thin wafers. Using the current industry standard manufacturing process for silicon wafers of 6 inches square and 200 μm thickness already results in bowing which is beyond the acceptable limit.

Invention

The present invention overcomes this problem. It allows complete elimination of the bowing in the finished solar cell prior to its further processing. It therefore ensures that acceptable tolerances required for the fabrication of modules can be met regardless of the wafer geometry and size. To achieve this, the finished solar cells are cooled to a certain temperature below room temperature. Temperatures of between -20°C and -50°C are adequate. During the cooling, a plastic deformation of the Al rear contacts takes place combined with a permanent lengthening and stretching. The bowing of the solar cell remains roughly unchanged.

During the subsequent reheating to room temperature, the aluminium contact expands more than the silicon wafer and the elastic strain is reduced. By carefully selecting the cooling temperature to match the wafer geometry and the quantity of AlSi paste applied to form the contacts, a wafer free of stress and thus free of bowing can be achieved at room temperature.

Your Advantage at a Glance:

- Silicon cells of 150 to 200 μm substantially free of bowing.
- Higher yield in wafers for the same quantity of pure silicon.
- Cooling temperatures of -20°C to -50°C .
- Simple processing step which can be easily integrated into existing production lines.

Technology Transfer

The Technologie-Lizenz-Büro GmbH is charged with the commercialization by the University of Konstanz and now offers companies the opportunity to obtain a licence to exploit this new and promising technology.

Patent Portfolio

German patent DE 10 2005 026 176 B3.
A European patent EP 06 011 508.6 is pending.

For further information on this „Bow Elimination“ technology, or other TLB Technologies on offer, please contact:

Dr.-Ing. Hubert Siller

hsiller@tlb.de

Technologie-Lizenz-Büro (TLB)
der Baden-Württembergischen Hochschulen GmbH

Ettlinger Straße 25, D-76137 Karlsruhe, Germany
Tel. +49 721 79004-0, Fax +49 721 79004-79
www.tlb.de