Busbarless Connection

Article Overview

Busbarless (0BB/ZBB) connections eliminate front-side busbars on solar cells, using fine gridlines and ribbons to collect current, improving efficiency and reducing material costs.

Overview

Busbars are metallic lines on solar cells that collect and transport electrical current. Traditional cells use multiple busbars (2BB to 21BB) to reduce series resistance, but they occupy surface area, causing shading and reducing light absorption. Busbarless technology, also called 0BB or ZBB, removes these busbars entirely. Instead, ribbons or wires collect current directly from the fine gridlines, which reduces shading, improves the cell-to-module (CTM) efficiency, and lowers silver usage by 30-50% per cell .

Electrical and Mechanical Considerations

Without busbars, contacting the fine gridlines becomes more complex. Each grid finger must be individually contacted, often requiring independent current and voltage contacts to minimize resistive losses and ensure accurate performance measurement . Techniques include:

o Wire-embedded EVA sheets: Cells are laminated with SnBiAg wires embedded in EVA, achieving low contact resistivity and high efficiency (~19.55%) at optimized lamination temperatures .
o Electrically Conductive Adhesives (ECA): Pads of ECA are applied to each finger, decoupling electrical contact from mechanical adhesion. This allows optimization of both conductivity and adhesion while reducing material usage .
o Metal connecting wires: In busbar-free modules, metal wires are soldered to the cell gridlines, simplifying alignment and reducing the risk of unstable connections .

Advantages
o Higher Efficiency: Less shading from busbars increases light absorption and improves CTM ratio.
o Material Savings: Reduced silver paste usage lowers production costs.
o Compatibility with Thin Wafers: Flexible connection methods allow the use of thinner silicon wafers, further reducing costs.
o Enhanced Stability: Multiple contact points reduce losses from microcracks and improve module reliability .

Applications

Busbarless technology is compatible with advanced solar cell types such as HJT (Heterojunction), TOPCon (Tunnel Oxide Passivated Contact), and back-contact cells, making it a versatile solution for high-efficiency PV modules . Industrial adoption has been growing, with mass production of 0BB cells already underway in

leading PV manufacturers .

Summary

Busbarless connections represent a significant evolution in solar PV technology. By eliminating busbars and using fine gridlines with ribbons or conductive adhesives, they enhance efficiency, reduce material costs, and improve module stability, while requiring careful design of electrical contacts and lamination processes to maintain performance. This technology is central to modern high-efficiency solar modules and is increasingly adopted in commercial production.

Busbarless solar cells become more and more important Measurement of current-voltage (I-U) characteristics of busbarless cells

Figure 3 is a schematic diagram of the connection between the cells and metal connecting wires of the busbarless solar photovoltaic

We present a module integration process for aluminum metalized, busbar-free back-junction back-contact solar cells by

Two different main approaches for measuring busbarless solar cells have evolved, representing either realistic or idealized

Smart Wire Connection Technology Smart Wire Connection Technology (SWCT) : Interconnection of busbarless solar cells by 15

5 Conclusion/summary We perform FDM simulations to test the approximation of Bothe et al. on the contacting of busbarless solar

Measurement systems for busbarless solar cells To investigate the influence of the contacting scheme on the performance of

For standard IBC cells busbars are printed perpendicular to the fingers and the insulation pads. Printing on the busbars levels the

Use of thin silicon (Si) wafers is enabled because of the reduced Ag metallization mass and by interconnection with conductive

A new cell calibration method allowing accredited laboratories to provide reliable and independent reference values for

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In recent years, solar cell development has undergone a major change in metallization layout. In their most radical form, busbarless

Back-contact crystalline-silicon photovoltaic solar cells and modules offer a number of advantages including the

Discover the 7 key benefits of busbar-less PV panels. These panels offer enhanced

Download scientific diagram | Busbarless cells and the GridTouch measurement, the SWCT concept and bifacial record module for

Astronergy presents TOPCon busbarless solar modules with 23% efficiency The Chinese module manufacturer

Busbarless cells are formed by screen printing, and busbarless cells cannot be measured with a general simulator jig.

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