Contacting busbarless (BB0) solar cells at ISFH CalTeC

Technical information (21a)

Deutsche Akkreditierungsstelle
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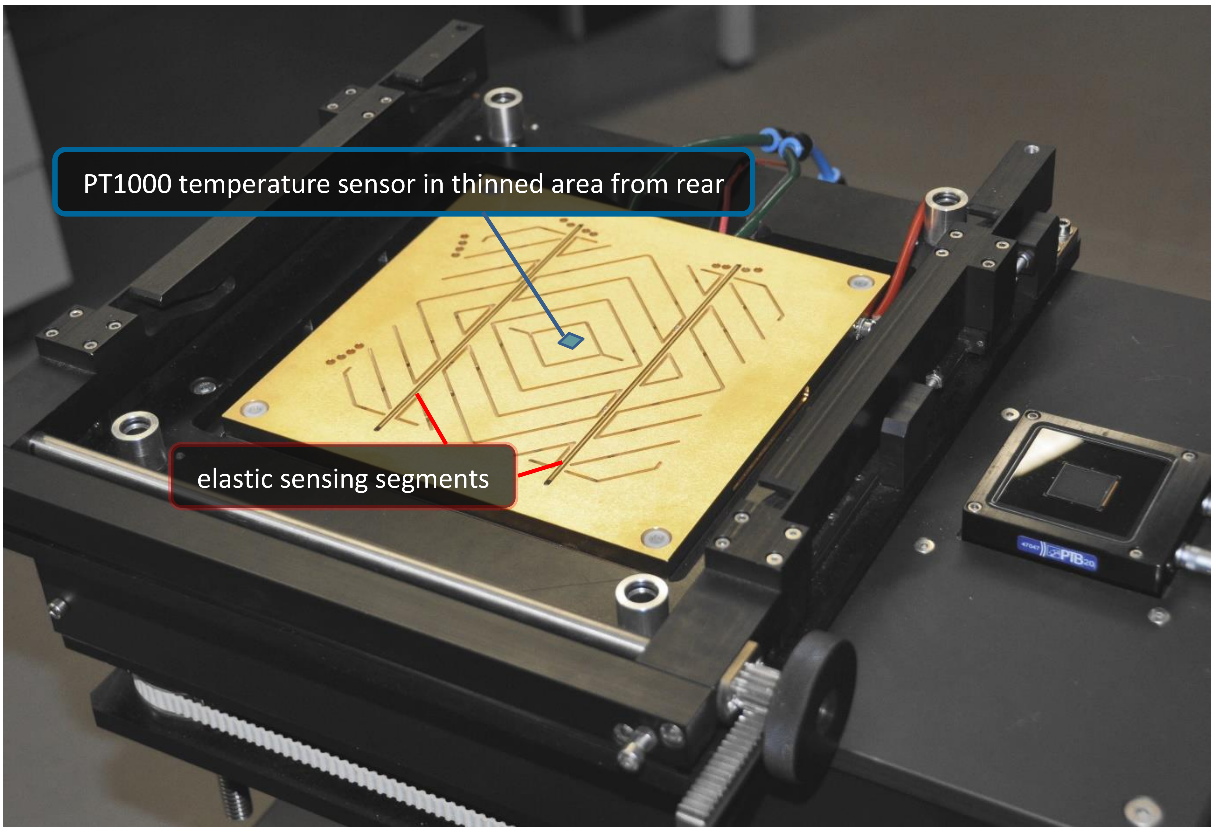

Fig. 1: Full area rear contacting unit for busbarless (BB0) solar cells.

The contacting unit at the ISFH CalTeC solar cell calibration laboratory allows certified measurements of busbarless bifacial and monofacial solar cells of up to 166 mm (M6) edge length.

The solar cells rear side is fully contacted and the sensing is performed by means of two embedded elastic sensing segments electrically isolated to the rest of the chuck. For bifacial solar cells, this contacting approach neglects the grid resistance of the rear metallization.

A PT1000 temperature sensor is integrated in a thinned area of the contacting unit. By this configuration, lateral temperature gradients between a sensor touching the solar cell and the surrounding temperature controlled chuck are omitted.

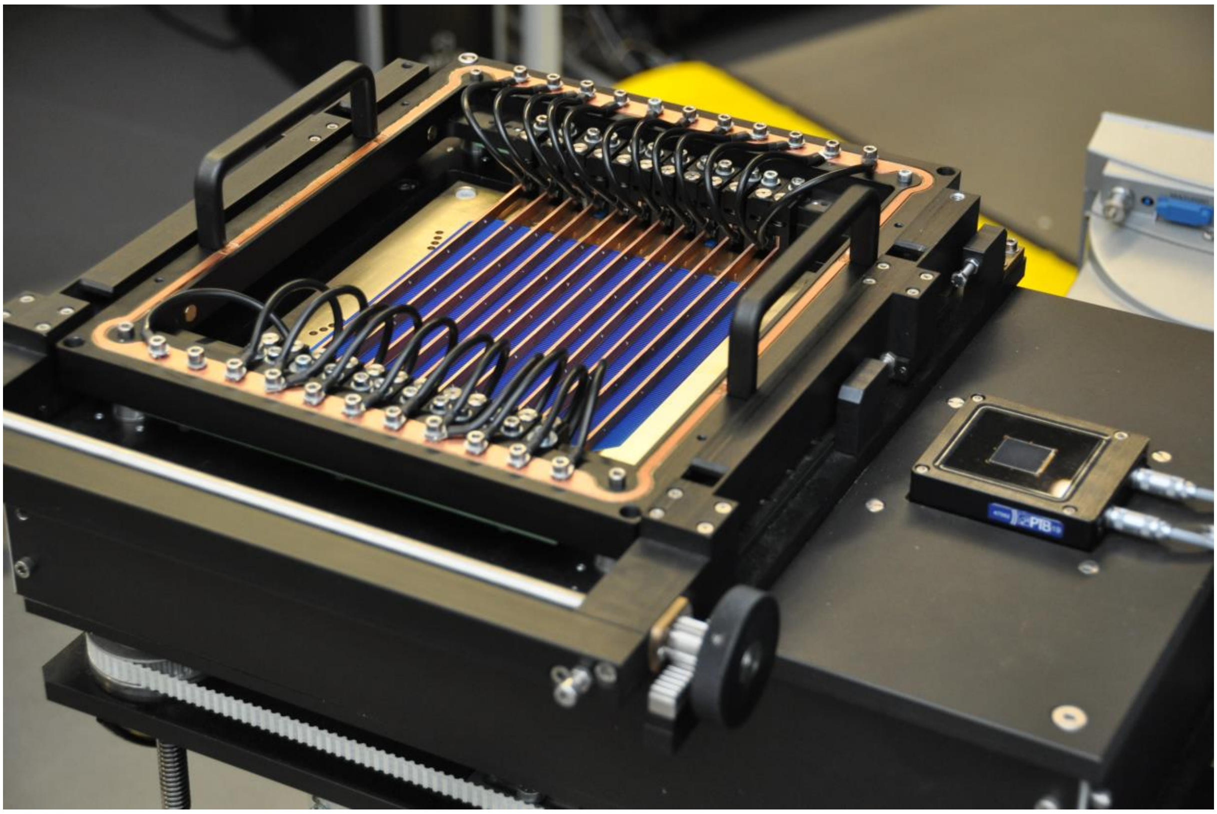

Fig. 2: Contacting the front side of busbarless (BB0) solar cells using 12 contacting bars and a sensing wire.

The solar cells front side is contacted by 12 contacting bars made from gold plated metallic foil wrapped around an elastic core. The contacting bars are designed and manufactured by pv-tools (www.pv-tools.de). Wires making contact to the solar cell by means of magnets in the underlying chuck are used for sensing.

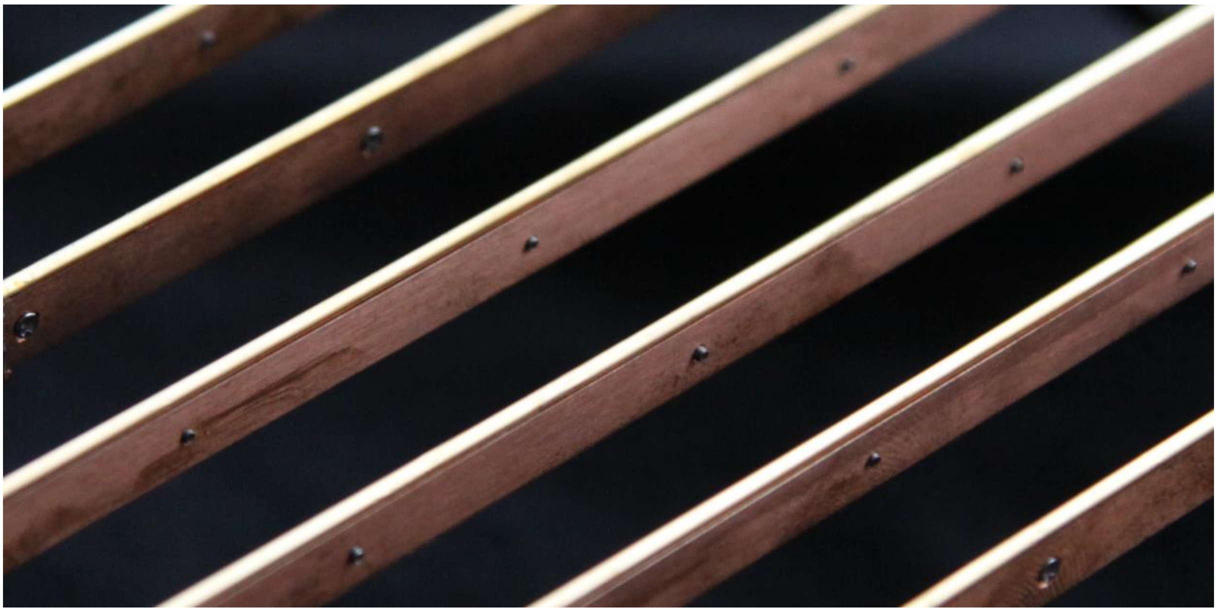

Fig. 3. Contacting bars made from gold plated metallic foil are designed and manufactured by pv-tools (www.pv-tools.de) for ISFH CalTeC.

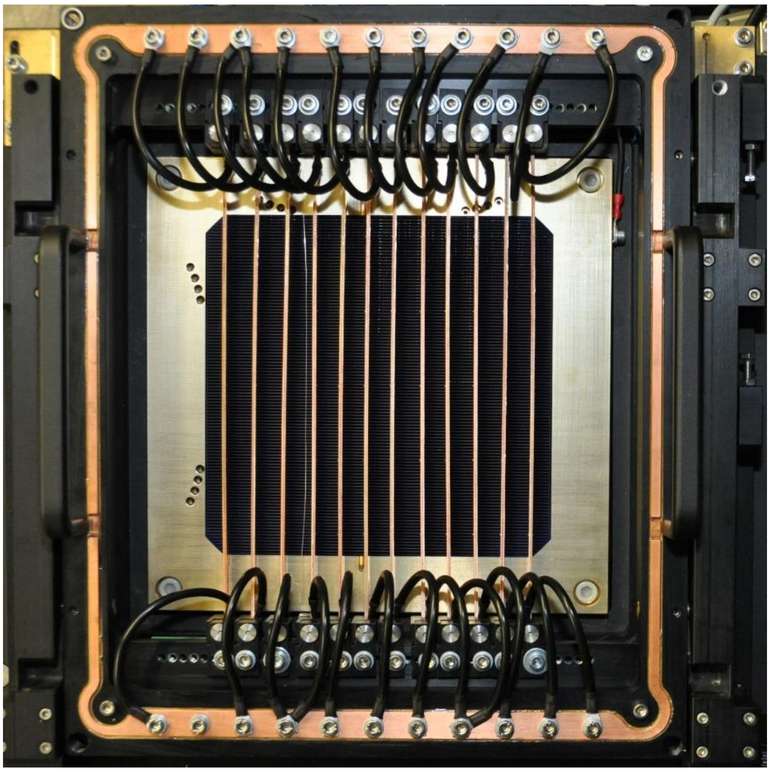

Fig. 4. Top view of a busbarless solar cell contacted by 12 contact bars and one sensing wire.

We use a grid resistance neglecting sensing scheme. Grid resistance neglecting means that the fill factor does not contain contributions of the finger resistance. We have deliberately chosen this contact scheme, because in all other cases the fill factor (FF) depends for high finger resistances on the contact layout. For example, if one places the sensing wire in the middle of the current-carrying contact bars, a measurement with 5 contact bars gives a higher FF than a measurement with 10 or 20 bars. In order to eliminate this dependence on the contact-layout, we position the voltage-measuring contact in such a way that we measure the characteristic IV curve corresponding to a contact scheme with an infinite number of (transparent) bars. Simulations for various grid resistances showed that a position at one-fifth of the distance of two current-carrying contacts is the ideal sensing position for this purpose. Exemplarily, a top view of a contacted busbarless solar cell with 12 contact bars and one sense wire is shown in Figure 4.

To determine the shading free short circuit current $I_{SC.0}$, we vary the number of contact bars. Fig. 5 shows a typical result of such a variation. The short circuit current is shown as a function of the number of contact bars used. $I_{SC.0}$ follows from extrapolation to zero bars.

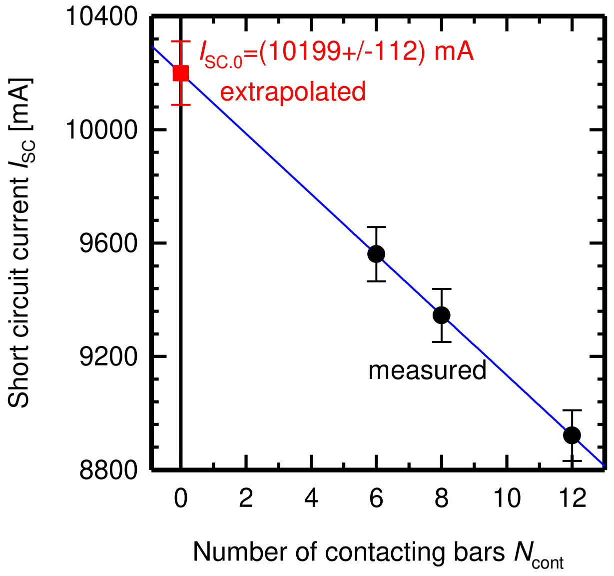

Fig. 5. Short circuit current as a function of the number of contacting bars. Measured values are shown as black circles. The shadow-free short circuit current $I_{SC.0}$, shown as red square, results from extrapolation to zero contact bars.

Contact

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