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Low cost semi automated assembly unit for small size back contact modules and low cost interconnection approach

Tobias Meßmer*, Fatih Demiralp, Andreas Halm

International Solar Energy Research Center - ISC Konstanz, Rudolf-Diesel-Str. 15, D-78467 Konstanz, Germany

Abstract

We present our low cost assembly unit to manufacture back contact solar modules based on the conductive backsheet (CBS) approach. This in house developed apparatus was built to assemble test modules containing one up to four 6 inch back contact solar cells. The system is a retrofit of a commercially available CNC system which is equipped with a cell grabber and a manual dispensing system (by Nordson). The total cost of the setup was roughly 4000 € excluding the dispenser unit. Using this equipment we assembled several small size modules containing one and four Zebra cells, which are low cost 6 inch IBC solar cells developed at ISC Konstanz [1, 2]. The contact between copper backsheet and back contact cell of the one cell modules we present here is formed by low temperature solder paste (LTSP). First cell to module (CTM) loss evaluations and reliability results suggest that this material could be a viable alternative to electrically conductive adhesive (ECA) which is currently the most commonly used material for this purpose.

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Keywords: back contact module assembly unit; low temperature solder paste; conductive backsheet module

1. Introduction

Low cost back contact cells and modules gain more and more relevance for industrial production [3, 4, 5]. The module integration of back contact cells is still challenging; the conductive backsheet approach [6] is the most prominent solution apart of classical stringing. Module assembly with conductive backsheets is mostly realized using

* Corresponding author. Tel.: +49-7531-36 18 3-6626
E-mail address: tobias.messmer@isc-konstanz.de

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specialized production equipment. We developed a low cost solution to assemble prototype back contact modules. As means for cell contacting LTSP is evaluated since it is easy to handle and has the potential to be a cheap substitute for ECA in future back contact module applications.

Nomenclature

CAM	computer-aided manufacturing
CBS	conductive backsheet
ECA	electrical conductive adhesive
LTSP	low temperature solder paste
CTM	cell to module
CNC	computerized numerical control

2. Assembly unit

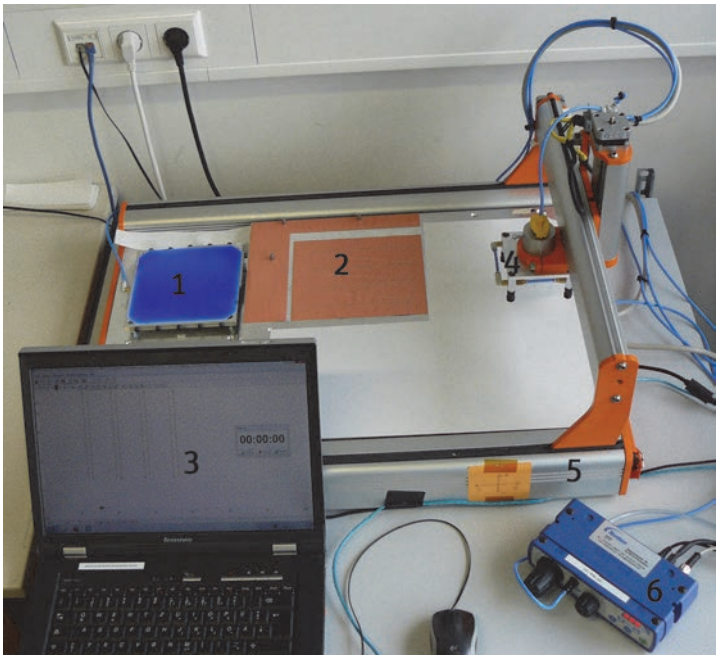

Figure 1: photo of the assembly unit; 1: Zebra cell on small vacuum chuck; 2: CBS for one-cell-module on big vacuum chuck; 3: Control Software; 4: Tool (dispenser or cell grabber); 5: CNC-System; 6: Dispensing unit

Our assembly (shown in Figure 1) was redesigned from a commercially available CNC-System from Stepcraft. Instead of the milling tool we attached a cell grabber and a manual dispensing system from Nordson to the machine head. It is fit to execute different process sequences to fabricate modules utilizing CBS of different architecture and suppliers. The cost for the whole setup was 4000 € exclusive the dispensing unit. We replaced the mounting plate of the original device by a custom made Al plate housing two vacuum chucks. A small chuck to place a solar cell where it can be picked up by the cell grabber and a large chuck that holds a CBS in place during the assembly process. Both vacuum chucks are designed to facilitate precise alignment of the cell or the CBS on referenced initial positions. Cell alignment is realized with limit stops on the small chuck; the CBS is aligned with pins on the big chuck. The top plate of the big chuck is removable and also aligns on the same pins as the CBS which are bolted on