A novel insulated solder tail assembly for use with aluminum core backsheets

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Introduction

Performance degradation of long term photovoltaic installations has been linked to moisture ingress into the modules through observations of moisture related corrosion and encapsulant adhesion loss. Multiple methods to reduce moisture penetration have been investigated over the years. These studies have primarily focused on the internal (encapsulant) or external (topsheet and backsheet) components of the module. These layers are typically classified by their water vapor transmission rating (WVTR). It has been shown in various studies that backsheets composed of thin continuous aluminum core have a significantly lower WVTR than conventional backsheet materials and are therefore one of the most effective ways to prevent moisture ingress into the module.

The use of aluminum core backsheets can unfortunately lead to other module reliability and performance issues. On conventional modules, the cell to cell bus bar material is typically extended through a narrow slit in the encapsulant and backsheet materials. This slit facilitates the electrical connection to the backside mounted junction box. The conductive nature of the aluminum in the backsheet poses a unique challenge. If the electrical leads are not properly insulated from the conductive layer, electrical shorting of the module leads to each other or to ground through the frame can occur. This shorting can manifest during the manufacturing process, or in the field as module materials age.

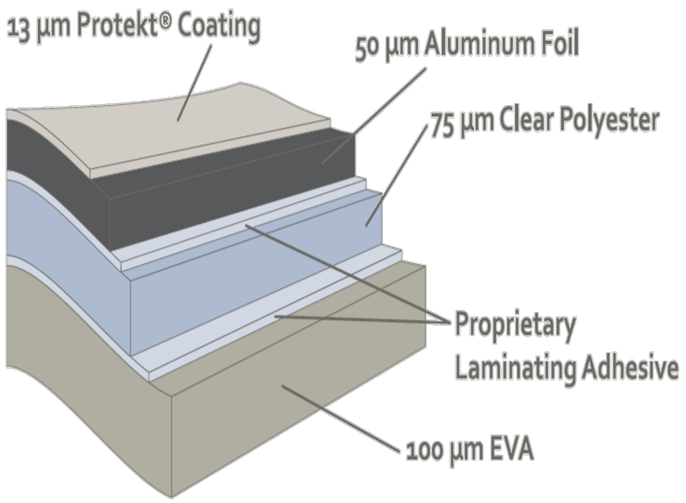

Figure 1. Cross-section of Madico's "Protekt TFB" aluminum core backsheet. Madico is one of multiple manufactures of aluminum core backsheets for use in the PV industry. Image is taken from Madico's product brochure available at: http://www.madico.com/wp-content/uploads/2011/06/Protekt-TFB-Datasheet-2011_web.pdf

This poster contains no confidential or proprietary information

Design Considerations

The backsheet of a PV module is considered an accessible component per the UL and IEC certification definitions. With the addition of the conductive layer an aluminum core backsheet can potentially be considered an accessible metal part. With these considerations in mind, the typical technique of passing bare bus bar material through the backsheet is no longer sufficient to satisfy the minimal acceptance creepage and clearance distances, as published in IEC 61730-1 and UL 1703. The electrical connection to the junction box must be made while the electrical insulation between current carrying components and accessible metal components is maintained per the safety standards of the product classification. The electrical insulation must also remain stable through the effective service life of the module as described in IEC 61215 and UL 1703. In addition to the safety and certification issues, relative ease manufacture and cost considerations must be evaluated for a product to be competitive in the market.

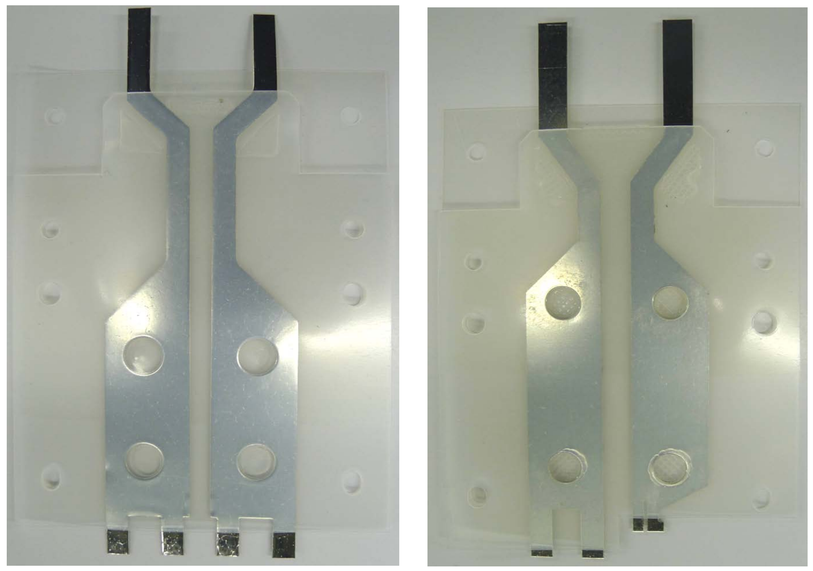

Figure 2. Two versions of Transform Solar's solder tail subassembly. Each of the individual module designs at Transform Solar have a unique tail configuration to accommodate the certification requirements

Tail Design

Transform solar has developed a novel solder tail subassembly which successfully over comes all the safety, certification, and reliability issues associated with aluminum core backsheets. The transform design consists of two legs composed of a standard Ag/Sn plated Cu alloy. The legs are surrounded with three layers of a commonly used insulating polymer that is designed to bond with the encapsulant material. The insulating layers allow the subassembly to be placed directly behind the active cells of the module, which helps decrease module size, weight, and materials costs.

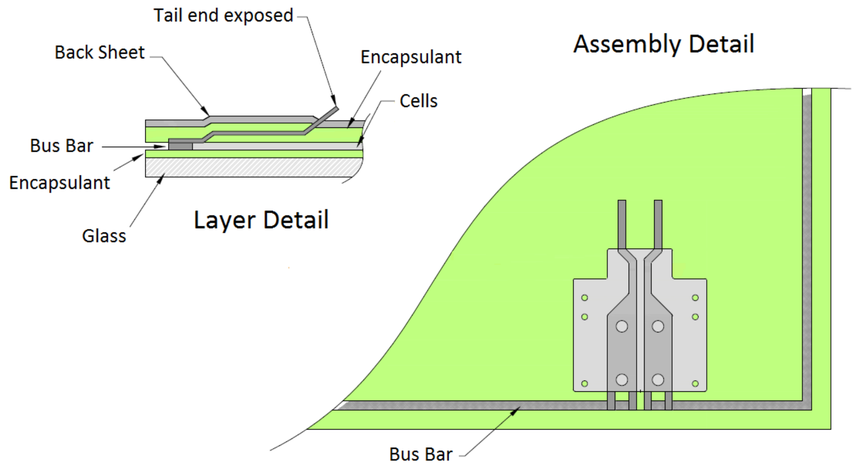

Figure 3. Assembly detail of Transform's solder tail subassembly

During the module assembly process the subassembly is soldered to conventional cell to cell BB material within the module and passed through a slit in the aluminum core backsheet. The module then goes through a typical laminating and final assembly procedure. The tails sub-assembly was first implemented with our series IV SLIVER™ module, which received IEC (TUV) certification in August, 2011.

About Transform Solar and SLIVER™ Technology

Transform Solar is a joint venture between Origin Energy and Micron Technology. Micron and Origin brought together their respective expertise in green energy and semiconductor manufacturing to contribute stability and strength to a visionary company with a leading new technology.

Our innovative SLIVER™ technology uses advanced semiconductor manufacturing techniques to create new opportunities for monocrystalline silicon solar power through a markedly different design. SLIVER™ technology was invented and developed at the Australian National University's Centre for Sustainable Energy Systems with financial support from Origin Energy. It produces ultra-thin, elongated monocrystalline cells that are perfectly bifacial and highly flexible. The SLIVER™ cell process uses an innovative micromachining technique to slice the wafer into thousands of tiny strips. The strips form fully functional solar cells, which are then separated from the wafer. The unique properties of these cells create potential for lighter panels, conformable structures, and a host of other new applications that were previously inaccessible to monocrystalline based technology . For more information visit: www.transformsolar.com

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