



## Case Study: PhotoMark Reflections

### *The Challenge* - - - - -

Greater focus on developing sustainability energy solutions has caused a boon in the solar industry. But little is known in the general public about the environmental sustainability of the products used in the manufacturing of items such as solar panels. The most common process requires multiple layers of film, glass, solar cells, and a backsheet.

Historically, the backsheet began as a glass product in the 1970s, which has great insulation properties but is also fragile and heavy. Although glass is still used in building integrated systems today, the industry evolved in the 1980s to a monolayer, PVF coated product with acrylic thermoplastic adhesive. This product had excellent bond to encapsulation materials, but independent testing by Sandia Laboratory found that 10-15% of the PV modules had cracks in the backsheet after only two years. Further analysis of the cracks showed that the product had failed dielectrically.

Although manufacturers were able to provide “technical service” fixes to these products, Worthen Industries knew that there was an opportunity to move the industry to an organic backsheet that is:

- Lighter weight to lower shipping costs and improve safety for roof installations
- Faster cycle time for lower thermal mass
- Reduced breakage and waste
- Lower cost for materials and production

Current backsheet products use films to produce backsheet via a lamination process, which requires solvent based adhesives to adhere the layers together, causing the burn-off of VOCs into the atmosphere. Additionally, the lamination production process creates waste, which is sent to the landfill.

### *The Process and Product* - - - - -

In 2012, Worthen Industries entered into a joint venture with Tomark, creating Tomark-Worthen LLC. The goal of this venture was to develop a new product for solar panel backsheets that is effective, durable and environmentally sustainable. Worthen and Tomark felt it essential that the product be produced within the United States at Worthen’s Nashua, New Hampshire facility.

With Tomark’s two decades of experience in making backsheets, combined with Worthen’s experience in extrusions and adhesives, there was a way to create a backsheet that performs well via a co-extrusion process, eliminating multiple

manufacturing steps and eliminating all solvents. Finding the best structure to provide the properties required while staying within strict cost parameters was challenging. After over two years of extensive research, testing various materials and structures an excellent product was created.

Ultimately, the team developed PhotoMark® Reflections™ with the following characteristics:

- Excellent bond to EVA, no oozing and superior toughness
- Zero waste and 100% recyclable
- No solvents to produce, VOC-free
- Long-term durability, no hydrolysis degradation in long-term damp heat
- High reflectivity
- RTI>90°C

## **Results** - - - - -

In addition to its properties, PhotoMark® Reflections™ has the advantage of versatility as it is customizable from 3 to 5 layers with easy color changes possible. Customers can enjoy the savings that come with high productivity and maximum yield with zero waste, as well as a single pass process.

Third-party certifications are being completed and the product should be available for commercial sales in early 2016.

Photomark® Reflections™ is the first of a platform of products to enhance solar panel performance. The team is already looking to additional innovations for this product, including new systems that include:

- Improved polyamide/polyolefin alloy multi-layered constructions
- Diverse material layers using a tie-layer approach for enhanced performance
- Additives for static control, heat dissipation, and MVTR properties

## **Best Practices** - - - - -

- Product and Industry Innovation
- Collaborative

## **Contact** - - - - -

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