

## **TECHNICAL ASSISTANCE REQUEST (2 pages, including images, will be made public)**

Provide a two-page description of the unique challenges and needs a national lab, private facility, and/or member of the American-Made Network could potentially help you resolve. The Prize Administrator will make this request broadly available so members of the American-Made Network can understand your needs and assist you through the voucher program or otherwise.

### **National Lab Collaboration with Dunmore International**

The design of any new product presents many challenges from both a technical and commercial perspective. In the case of Dunmore's transparent barrier films, the key technical challenges include:

- Selection and screening of suitable films and adhesives for the multi-layer constructions
- Initial testing and validation of product design including transparency and barrier properties
- Long term testing of barrier film constructions to ensure a sufficiently robust design

Above all, demonstrating long term performance of materials exposed to extreme temperatures, UV and moisture represents the greatest technical challenge in this particular product development. Additionally, since the materials need to last for 20 or more years, accelerated weathering tests are necessary to gain an understanding of potential failure modes and field service life. Most commonly, Dunmore uses "damp heat" testing at 85 deg. C and 85% RH for 250 to 3000 hrs.

### **Laboratory Testing**

In the case of polymeric materials, using a combination of temperature, humidity and mechanical stress has been proven more effective by NIST and other government labs in simulating long-term material performance. This type of testing equipment is very expensive and is beyond the budget of this project. Regarding assistance from National Labs, Dunmore will request the following testing:

- Damp Heat Test Validation – 85 deg. C and 85% RH for 250 to 3000 hrs.

- Mechanical testing of laminated polymer barrier films
- Moisture Vapor Transmission Rate (MVTR) Validation
- Spectrophotometric Color and Transmission and consistency
- Electrical tests such as Distance Through Insulation per IEC 61730
- Xenon arc testing – solar simulation
- Peel strength and adhesion to encapsulant (after damp heat testing)

## **Module Testing**

Another limitation of material suppliers is that they generally have no ability to incorporate and test their materials into higher level assemblies. This includes Dunmore. There are multiple mechanical and CTE stresses that occur at elevated temperatures when polymer films are laminated to flexible and rigid structures. It would be beneficial for national labs and potential module manufacturers to test Dunmore films for adhesion to encapsulants as well as dielectric properties.

## **Field Testing**

Likewise, field testing of final module construction is something Dunmore does not have the ability to do. It would be helpful for national labs and module manufacturers to assistance in this area. Evaluating material weathering results from field installations in various climates would be insightful in extrapolating failure modes and improving material selection and construction of future generation products. Particularly in the case of PV front sheets, field testing is critical in assessing product worthiness.

## **Material Collaboration & Other Photovoltaic Applications for Polymer Films**

The goal of Dunmore's transparent barrier film development is to share prototype quantities of engineered films with research labs and module manufacturers to assist in their new product innovation. Providing free 1000 mm x 20m rolls to designated research organizations and commercial enterprises will offset their R & D material costs and provide a "multiplier-effect" of accelerated innovation. For Dunmore, this is intended to obtain collaborative feedback as new and improved versions of our films are developed. For research organizations, the availability of small quantities of custom films will be beneficial from both a financial and technical perspective.

With future product development, transparent barrier films can be incorporated into other aspects of the photovoltaic bill of materials including:

- **Repair tapes**
- **Solar Concentrator films**
- **Reflectors for improve bifacial efficiency**
- **Reflective Grids**
- **Building integrated photovoltaic materials**
- **Specialized flexible and rigid PV materials**
- **Specialized films for aerospace, transportation, portable applications**

For future development proposals, Dunmore would like to develop specialize capabilities to produced repair tapes for the field repair of PV modules. In addition, metallized and embossed films for specialized bifacial applications is an area that we would to develop in the future with the assistance of collaborative National organizations such as NREL.

