NREL Highlights RESEARCH & DEVELOPMENT

Technical Study Addresses a Key Challenge to Harmonizing U.S. and International PV Module Standards

NREL builds community and industry support by addressing concerns voiced by key standards organizations.

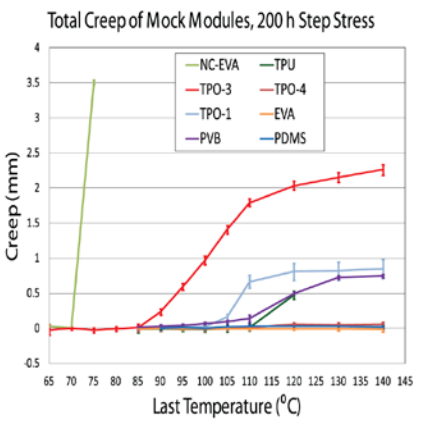
Photovoltaic (PV) manufacturers in the United States test the safety of their products using standards developed through consensus processes. Because U.S. PV module safety standards are not aligned with international standards, manufacturers must test their modules twice—and sometimes maintain separate product lines. By meeting with standards organizations such as the Solar ABCs and Underwriters Laboratories (UL), National Renewable Energy Laboratory (NREL) leaders have worked to identify different stakeholders' priorities and concerns. UL, specifically, has expressed concern that the international standards do not address all possible risks. For example, new encapsulant materials could soften at high temperatures and frameless modules could slide apart, exposing live electrical parts or allowing glass to fall on a person below. The deformation of a solid material under the influence of mechanical stresses is known as "creep." Current module qualification tests are limited to 85°C, whereas modules can, for short times, reach 105°C outdoors.

In response to UL's concern, NREL designed and executed an experiment to compare on-sun and accelerated rates of creep for modules fabricated with various encapsulants, including some that have low melting points. Objectives were to 1) evaluate the potential for creep in outdoor exposure, 2) provide guidance on the risks and design needs with thermoplastic materials, and 3) provide a basis for modifying standards to account for materials with potential to creep. The study tested experimental materials with eight representative encapsulants in both outdoor and indoor (chamber) exposure.

The study found that modules with materials that were expected to creep did so in the indoor exposure, but not in most outdoor environments and mounting configurations. The results provide a basis for defining an accelerated test needed to give confidence that the modules will not slide apart on hot days. The proposal for IEC 61730 Part 1 exposes modules for 200 hours to a temperature between 105°C and 110°C. NREL is collaborating with UL representatives, and U.S. and international standards appear to be closer to harmonization.

Technical Contacts: John Wohlgemuth, *john.wohlgemuth@nrel.gov;* Michael Kempe, *michael.kempe@nrel.gov*

Reference: Kempe et al. (February 2012). "Testing Protocol for Module Encapsulant Creep." NREL/PR-5200-54583. *http://www.nrel.gov/docs/fy12osti/54583.pdf.*



Test results of creep levels of various PV module types.

Key Research Results

Achievement

NREL worked with the community to design and execute an experiment comparing on-sun and accelerated rates of creep for modules fabricated with encapsulants, including some that have low melting points. Serving as a neutral third party, NREL addressed the issue in a scientifically rigorous manner and produced results vital to the PV community.

Key Result

The results provide a basis for determining an accelerated test needed to give standards organizations confidence that the modules will not slide apart in the field on a very hot day. The effort has garnered community support from AIST, ASU, First Solar, Dupont, Dow Chemical, Arkema, UL, STR, Dow Corning, and others.

Potential Impact

This study provides accurate testing parameters that may be used to update IEC 61730, Part 1, and addresses a key barrier to harmonizing U.S. PV module standards with international standards.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

15013 Denver West Parkway | Golden, Colorado 80401 | 303-275-3000 | www.nrel.gov

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

NREL/FS-5200-54528 • July 2012