# ● Evaluation of Degradation of Polymer Encapsulants in Photovoltaic Cell

TNE0011

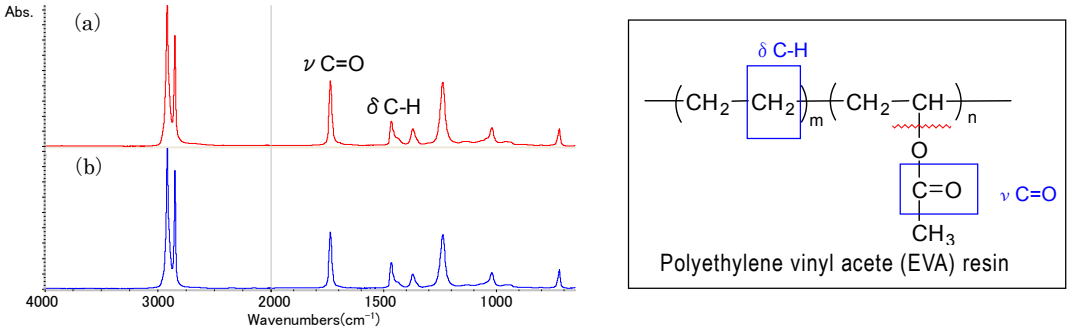
## Overview

Polyethylene vinyl acetate (EVA) is widely used as a polymer encapsulant for photovoltaic cells. An understanding of the durability and degradation mechanism of the polymer encapsulants is of great importance in ensuring a long service life for a photovoltaic cell.

This paper describes an example of the environmental testing of EVA, and analysis of the degradation mechanism using measurements by Fourier transform-infrared spectroscopy (FT-IR) of the sample before and after testing.

## **Example:** Structural changes before and after environmental testing

The environmental testing involved photoresistance tests using a xenon lamp, and temperature cycle testing were conducted. Figure 1 shows the IR spectrum before and after 362 hours of light irradiation. The C=O stretching vibration ($\nu$C=O) of the vinyl acetate (VA) units and the C-H deformation vibration ($\delta$C-H) which is an indicator of the ethylene units were identified from the resulting spectra.




(a) Before photoresistance testing (b) After photoresistance testing

Fig.1 Results of FT-IR measurements of EVA resin (VA content 18%) before and after photoresistance testing.

When the absorbance ratios for these absorption peaks were determined, it was clear that the $\nu$C=O absorbance declined relatively in both the photoresistance tests (Fig.2) and the temperature cycle tests (Fig.3), and the reduction in VA units was confirmed.

It was inferred that the degradation of the EVA resin arose from decomposition accompanied by the loss of acetic acid, rather than the reduction in VA units. Analysis of the gases generated under ultraviolet irradiation when modeling EVA photoresistance testing (UV-Py-GC/MS: See TN349) confirmed the detection of acetic acid, and confirmed the degradation mechanism suggested here.

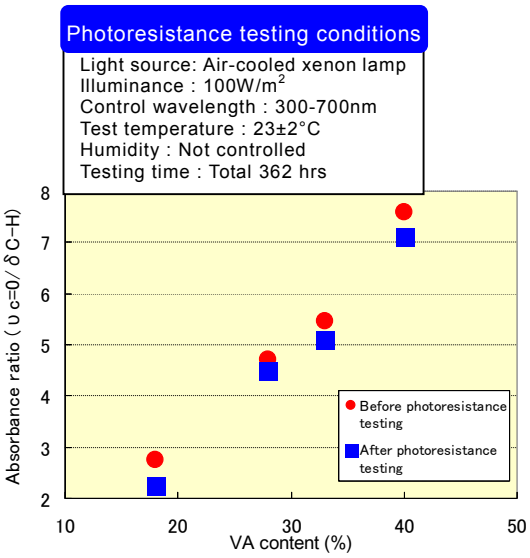



Fig.2 VA content – absorbance ratio before and after photoresistance testing.

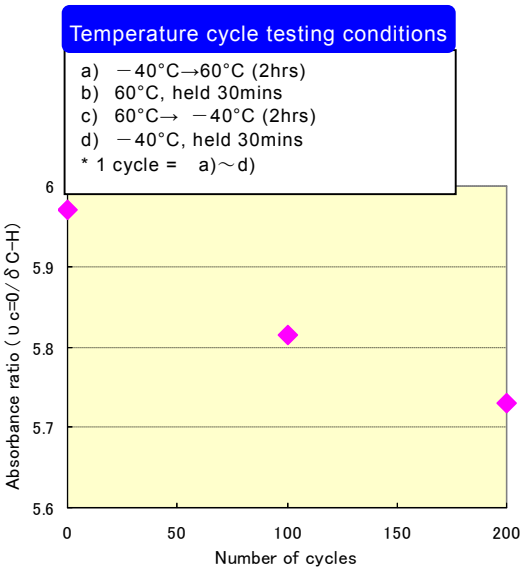



Fig.3 Absorbance ratios before and after temperature cycle testing.

Created by SCAS: https://www.scas.co.jp/technical-informations/technical-news/pdf/tn346.pdf

*Total solution partner for **analyses**, **measurements**, and **evaluations**.*
SCAS SINGAPORE PTE LTD
[Laboratory] 17 Sakra Road, Pulau Sakra, Singapore 627886
[Office] 1 Gateway Drive,#09-09, Westgate Tower, Singapore 608531
E-mail: scass@scass.com.sg WEB site: https://www.scass.com.sg/