

SEMI PV45-0513 (Reapproved 0519) TEST METHOD FOR THE CONTENT OF VINYL ACETATE IN ETHYLENE-VINYL ACETATE APPLIED IN PHOTOVOLTAIC MODULES USING THERMAL GRAVIMETRIC ANALYSIS

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1 Purpose

1.1 The purpose of this Standard is to standardize a fast and accurate test method for the content of vinyl acetate (VA) in poly ethylene-vinyl acetate (EVA) using thermal gravimetric analysis (TGA) method.

2 Scope

2.1 This Test Method characterizes the VA content of EVA in photovoltaic modules.

2.2 This Test Method covers the VA content test using a TGA instrument.

2.3 This Test Method is intended for the EVA film.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 None.

4 Referenced Standards and Documents

4.1 None.

5 Terminology

5.1 Refer to the SEMI International Standards: Compilation of Terms (COTs) for a list of the current Abbreviations, Acronyms, Definitions, and Symbols.

5.2 Abbreviations and Acronyms

5.2.1 °C — degrees Celsius

5.2.2 EVA — ethylene-vinyl acetate

5.2.3 g — gram(s)

5.2.4 m — milli

5.2.5 min — minute(s)

5.2.6 VA — vinyl acetate

5.3 Definitions

5.3.1 *thermal gravimetric analysis (TGA)* — thermal gravimetric analysis is a method where a sample is placed in a certain environment where the temperature is changed and the resulting change in weight is measured. Weight change is also observed when decomposition, combination, desorption, absorption, dehydration or sublimation occur.

5.3.2 *WL%* — the sample weight loss percentage in the first stage, as shown in Figure 1.

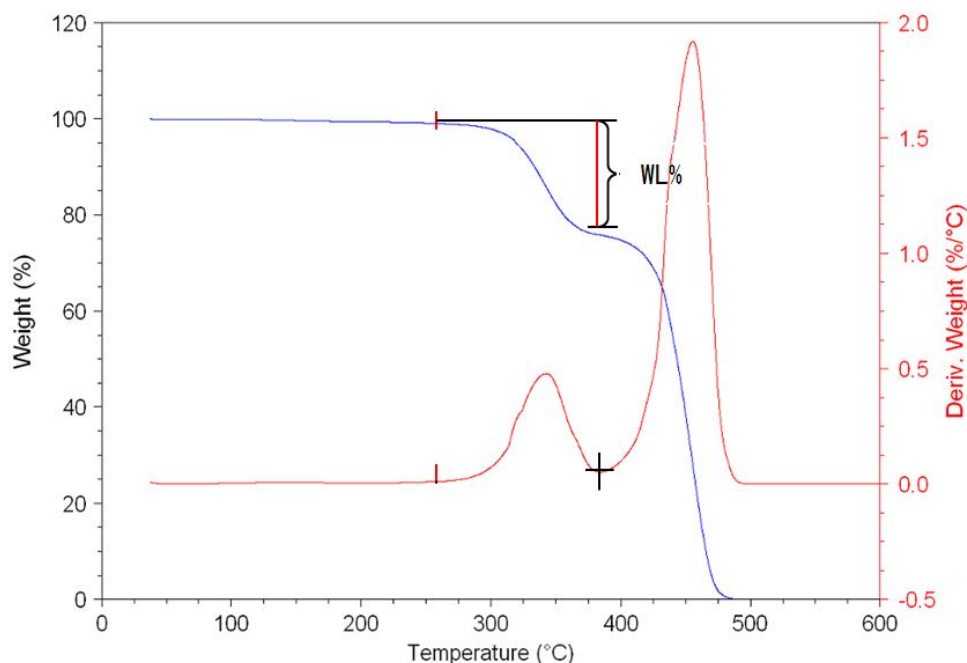


Figure 1
Diagram of the Sample Weight Loss Percentage in the First Stage

6 Summary of Test Method

6.1 The TGA method measures the relationship between the quality and the temperature when the testing material is subject to temperature changes. TGA also analyzes the relationship between weight and time in constant temperature conditions where it can be used to characterize any material that exhibits a weight change and to detect phase changes due to decomposition, oxidation, or dehydration.

6.2 A small sample is prepared before the instrument test.

6.3 The process for raising temperature is carried out by the TGA instrument, and the relationship between weight change and temperature is analyzed.

6.4 The VA content is calculated according to the weight loss and the ratio of molecular weight.

7 Apparatus

7.1 Following major components are included by the TGA instrument:

7.1.1 *Balance* — The key component of TGA instrument, used for accurate measurement of the weight of samples.

7.1.2 *Heating Furnace* — Heats the sample and control sample temperature.

7.1.3 *Heat Exchanger* — Provides heat to the furnace.

7.1.4 *Purge Gas Flow Controllers* — Control and measure the pure gas for sweeping and cleaning the balance and furnace.

8 Reagents and Materials

8.1 *Purge Gas* — Nitrogen (Purity: $\geq 99.99\%$).

9 Safety Precautions

9.1 *Chemical Safety* — Do not use hydrogen or any other explosive gas in the heating furnace of the TGA instrument. If the samples used emit harmful gases, vent the gases by placing the instrument near an exhaust.