

SEMI PV67-0815 (Reapproved 0221) TEST METHOD FOR THE ETCH RATE OF A CRYSTALLINE SILICON WAFER BY DETERMINING THE WEIGHT LOSS

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1 Purpose

1.1 The purpose of this Standard is to standardize a fast and accurate test method for the etch rate of a crystalline silicon wafer by determining the weight loss.

2 Scope

2.1 This Standard specifies the test method of crystalline silicon wafer etch, edge isolation etch, polishing and other corrosion rate.

2.2 This Standard applies to the testing of etch rate in the process of making cells.

2.3 This Standard specifies the corrosion time.

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 Referenced Standards and Documents

3.1 ISO Standards¹

ISO 14644-1:1999 — Cleanrooms and Associated Controlled Environments – Part 1: Classification of Air Cleanliness

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

4 Terminology

4.1 Definitions

4.1.1 *crystalline silicon wafer etch* — the phenomena that silicon surface material is destroyed, due to chemical reaction with around liquid in the wafer cleaning step.

4.1.2 *depth of etch* — the average depth of the sample surface damage layer.

4.1.3 *edge isolation etch* — achieve insulation of both sides of after the semi-finished solar cell with chemical methods.

4.1.4 *etch rate* — what loss of weight per unit area of materials in unit time.

5 Summary of Test Method

5.1 Choose the appropriate acid solution contact with silicon material samples for chemical etch, record etch times, and mass difference before and after etch with electronic balance, etch depth of the sample is obtained by Equation 1, Equation 3 is deduced by Equation 2, calculate the etch rate through Equation 3.

¹ International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland; Telephone: +41.22.749.01.11, <http://www.iso.org>

5.2 The etch rate is derived through corrosion depth:

$$\Delta h = \frac{W_1 - W_2}{S \times \rho} \quad (1)$$

where:

Δh = corrosion depth after the etch of wafer (μm),

W_1 = original weight of sample (g),

W_2 = weight of the sample after removal of surface corrosion (g),

ρ = density of silicon (g/cm^3), and

S = double-sided Corrosion area of the sample (cm^2).

$$\Delta h = v \times T \quad (2)$$

where:

v = etch rate ($\mu\text{m}/\text{s}$),

T — time of etched (s), and

Δh = corrosion depth after the etch of wafer (μm).

$$v = \frac{W_1 - W_2}{S \times T \times \rho} \quad (3)$$

where:

v = etch rate ($\mu\text{m}/\text{s}$),

W_1 = original weight of sample (g),

W_2 = weight of the sample after removal of surface corrosion (g),

S = double-sided Corrosion area of the sample (cm^2),

T = time of etched (s), and

ρ = density of silicon (g/cm^3).

6 Apparatus

6.1 *Electronic Balance* — Range (0–220) grams, Readability 0.0001 g, Repeatability 0.0001 g, Tolerance ± 0.0002 g.

7 Safety Precautions

7.1 Power switch and power outlet of the balance are checked in security before and after use.

8 Test Specimens

8.1 Take same batch wafers to be etched load in carrier cassette, select each piece of one from both end and the middle position, total take three pieces. Identify separately.

9 Preparation of Apparatus

9.1 Because of the high sensitivity of the crystalline silicon wafer surface, the testing environment should meet the following requirements:

9.1.1 Environment temperature should be $25^\circ\text{C} \pm 2^\circ\text{C}$, and relative humidity $60\% \pm 20\%$.

9.1.2 Environmental cleanliness should be better than 4 grade clean room requirements as defined in ISO 14644-1-1999, Cleanrooms and Associated Controlled Environments – Part 1: Classification of Air Cleanliness.

10 Calibration and Standardization

10.1 The balance is zero calibration before using the electronic balance.