

# SEMI PV97-1220

## SPECIFICATION FOR SILICON POWDER USED IN POLYSILICON PRODUCTION

This Standard was technically approved by the Photovoltaic - Materials Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on August 26, 2020. Available at [www.semiviews.org](http://www.semiviews.org) and [www.semi.org](http://www.semi.org) in November 2020.

### 1 Purpose

1.1 Silicon powder is an important raw material for the production of polysilicon, it is used for the synthesis of trichlorosilane and hydrosilylation of silicon tetrachloride. The quality of silicon powder has direct influence on the quality of trichlorosilane.

1.2 With the improvement of polysilicon production technology, the quality of polysilicon products is getting higher and higher, and the requirements on the quality of silicon powder are also getting higher and higher.

1.3 This Specification is to guide polysilicon manufacturers to obtain higher quality raw materials.

### 2 Scope

2.1 This Specification specifies the classification and test methods of silicon powders for polysilicon production.

**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 SEMI Standards and Safety Guidelines

SEMI PV59 — Test Method for Determination of Total Carbon Content in Silicon Powder by Infrared Absorption After Combustion in an Induction Furnace

SEMI PV64 — Test method for Determining B, P, Fe, Al, Ca Contents in Silicon Powder for PV Applications by Inductively Coupled Plasma Optical Emission Spectrometry

#### 4.2 ISO Standards<sup>1</sup>

ISO 2395 — Test Sieves and Test Sieving – Vocabulary

ISO 2591 — Test Sieving – Part 1: Methods Using Test Sieves of Woven Wire Cloth and Perforated Metal Plate

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

### 5 Terminology

5.1 Refer to the SEMI Standards Compilation of Terms (COTs) for a list of the most current terms and their definitions.

#### 5.2 Definitions

5.2.1 *particle size* — reference standard ISO 2395.

5.2.2 *sample* — representative part taken from a quantity of material.

5.2.3 *test sample* — sample which is used in the test.

<sup>1</sup> 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>

5.2.4 *test sieve* — sieve which conforms to a test sieve standard specification for use in particle size analysis by sieving.

## 6 Requirements

6.1 The requirements of various grades of silicon powder are listed in Table 1.

**Table 1 Silicon Powder Classification and Requirements**

|           | <i>Class I</i> | <i>Class II</i> | <i>Class III</i> | <i>Class IV</i> |
|-----------|----------------|-----------------|------------------|-----------------|
| B (mg/kg) | ≤20            | ≤20             | ≤30              | ≤30             |
| P (mg/kg) | ≤30            | ≤30             | ≤50              | ≤50             |
| Fe (g/kg) | ≤1.00          | ≤3.00           | ≤4.00            | ≤5.00           |
| Al (g/kg) | ≤1.00          | ≤2.00           | ≤2.00            | ≤5.00           |
| Ca (g/kg) | ≤0.10          | ≤0.30           | ≤1.00            | ≤3.00           |
| C (g/kg)  | ≤0.50          | ≤0.50           | ≤1.00            | ≤1.00           |

6.2 *Particle Size* — The size of silicon powder is to be mutually agreed between customer and supplier.

## 7 Test Methods

7.1 Measure the contents of B, P, Fe, Al, Ca in accordance with SEMI PV64.

7.2 Measure the content of C in accordance with SEMI PV59.

7.3 Particle size measurement

7.3.1 *Apparatus and Materials*

7.3.1.1 Vibration sieve machine

7.3.1.2 Test sieve

7.3.1.3 *Electronic Balance* — 0.01 g accuracy.

7.3.2 *Operating Procedure*

7.3.2.1 Mix 1000 g silicon powder samples evenly, divide samples according to the conical quartering method, get the test sample (about 100 g), weigh the test sample mass with electronic balance.

7.3.2.2 Assemble the test sieve chassis, small aperture test sieve and large aperture test sieve in order from bottom to top, transfer the test sample to the upper large aperture test sieve, close the lid.

7.3.2.3 Fix the test sieves on the vibrating sieve machine and run for 15 minutes for test sample screening.

7.3.2.4 Weigh the mass of silicon powder on the upper layer test sieve with electronic balance:  $m_1$ .

7.3.2.5 Weigh the mass of silicon powder on the down layer test sieve with electronic balance:  $m_2$ .

7.3.2.6 Weigh the mass of silicon powder on the test sieves chassis with electronic balance:  $m_3$ .

7.3.3 *Calculation*

$$w_i = \frac{m_i}{m_1 + m_2 + m_3} \times 100\% \quad (1)$$

where:

$w_i$  = mass fraction of silica powder in different particle size range (% w/w),

$m_i$  = mass of silicon powder in different particle size range (g), and

$i$  = from 1 to 3.