

SEMI PV53-0514 (Reapproved 1220)

TEST METHOD FOR IN-LINE MONITORING OF FLAT TEMPERATURE ZONE IN HORIZONTAL DIFFUSION FURNACE

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1 Purpose

1.1 This Document covers the test method of flat temperature zone in horizontal diffusion furnace including the testing principle, testing devices, environment, testing steps and the calculation of the flat-temperature zone.

2 Scope

2.1 This Test Method is used for testing flat temperature zone in horizontal diffusion furnace. Horizontal PECVD equipment, horizontal vacuum annealing furnace, horizontal alloy furnace and other similar equipments can also be implemented by reference.

2.2 This Test Method can be applied to evaluate the performance of the heater tube in horizontal diffusion furnace.

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 — Clean rooms and Associated Controlled Environments – Part 1: Classification of Air Cleanliness

3.2 China National Standards²

GB/T 1598 — Platinum-10%Rhodium/Platinum Thermocouple Wires, Platinum-13% Rhodium/Platinum Thermocouple Wires, Platinum-30%Rhodium/Platinum-6%Rhodium Thermocouple Wires

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

4 Terminology

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

4.2 Definitions

4.2.1 T_p — the process temperature which is needed to reach in the diffusion process.

4.2.2 Δt — the allowable deviation of the flat-temperature zone temperature.

4.2.3 T_{max} — the maximum coordinated temperature value in the flat-temperature zone. In other words, process temperature T_p plus Δt ($T_{max} = T_p + \Delta t$).

4.2.4 T_{min} — the minimum coordinated temperature value in the flat-temperature zone. In other words, process temperature T_p minus Δt ($T_{min} = T_p - \Delta t$).

4.2.5 T_i — the temperature detected by thermocouple in the i position.

4.2.6 *flat-temperature zone* — consecutive temperature area in which the each T_i between T_{max} and T_{min} along the axial direction of the furnaces.

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>

² China National Standards, Standardization Administration of the People's Republic of China, No.9 Madian Donglu, Haidian District, Beijing, China; Telephone: 86.10.82262609, Fax: 86.10.82260684, <http://www.sac.gov.cn/>

4.2.7 *in-line monitoring* — the testing of flat-temperature zone under the process temperature and process gas flow rate (suggested: 25 SLM).

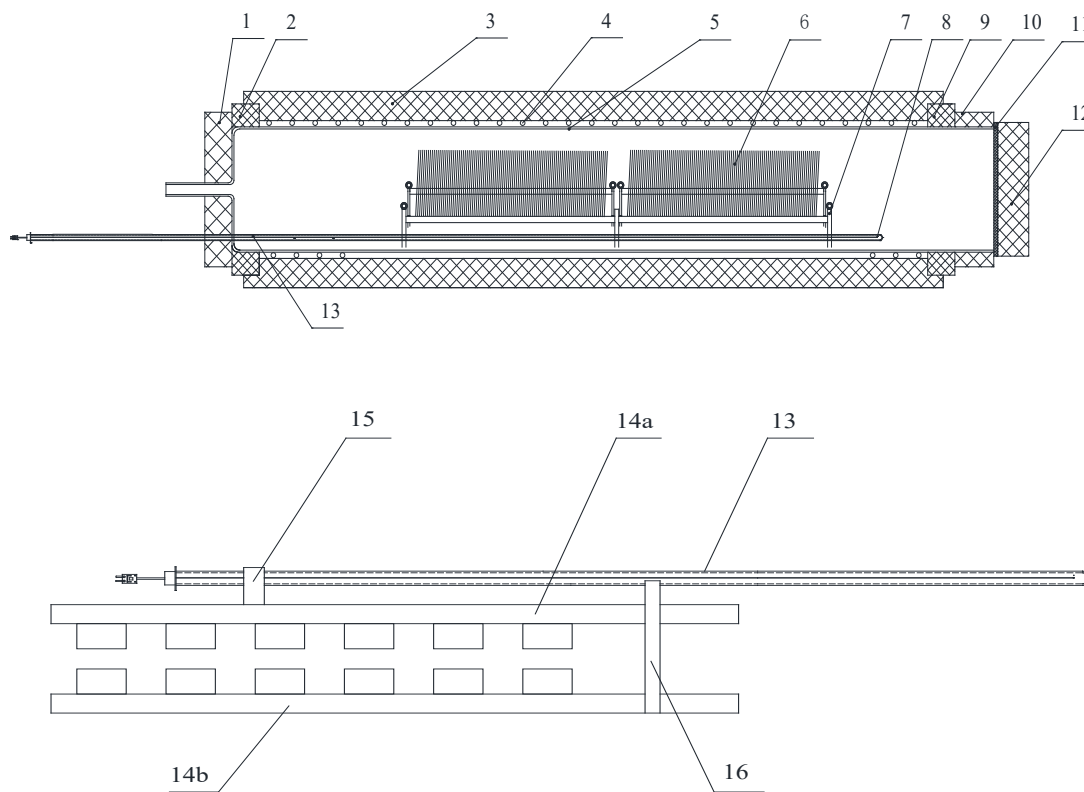
4.2.8 *Ld* — the design length of flat temperature zone in furnace.

4.2.9 *Lf* — the longest length of flat temperature zone in furnace.

4.2.10 *Δl* — the step length between two test point.

5 Summary of Test Method

5.1 This Test Method uses the single point measuring. A single thermocouple is driven to measure the flat temperature zone of horizontal diffusion furnace by a linear motion mechanism (such as linear motors, linear modules, etc.). The principle is shown in Figure 1. The thermocouple measuring point extends into the furnace body of the horizontal diffusion furnaces, and the other terminal is fixed to the moving parts of the linear motion mechanism by a clamp. The base of the linear motion mechanism is immobile, and the left side of the base is equipped with a thermocouple support base which is located on the central position of the thermocouple to support the thermocouple avoiding thermocouple fracture. This measured temperature value is collected by temperature data logger. The industrial personal computer (IPC) is used to control the linear motion mechanism and the temperature data logger.



#1 1- tail thermal insulation cotton; 2- ring-shaped thermal insulation cotton; 3- thermal insulation cotton of heater; 4-heating wire; 5-quartz tube; 6-wafer; 7-quartz loader; 8-temperature detection point; 9- ring-shaped thermal insulation cotton; 10-end ring-shaped thermal insulation cotton; 11-sealing quartz door; 12- door thermal insulation cotton; 13- thermocouple; 14a- the moving parts of the linear motion mechanism; 14b- the base of the linear motion mechanism; 15-clamp; 16- parts for supporting thermocouple

Figure 1
Diagram of Test Principle