Typical Pholysilicon Gate Process Recommendation Using PhosPlus

Prepared For		Source Type	TP-250
Application	Polysilicon	Part Number	7263A
Sheet Resistivity After Predep	12 ohms/sq.(epi) 13 ohms/sq.(5000 A poly) 32 ohms/sq.(2500 A poly)	Source Size	150x3.0mm
		Diffusion Tube ID	225mm
Junction After Predep		Preparation	JER1993

New sources may be cleaned and must be properly aged before they are used in testing or production. Refer to Product Bulletin aging for instructions. In this process, the sources should be aged at the recommended deposition temperature for at at least 6 hours but no longer than 8 hours.

Deposition Cycle

Step	Rate/Time	Temp	Gas	Flow Rate
Insert	2.5"/Minute	700°C	N2	15 lpm
Stabilize	15 Minutes	700°C	N2	15 lpm
Ramp Hold	3°C/Minute	900°C	N2	15 lpm
Ramp	60 Minutes	900°C	N2	15 lpm
Pull	3°C/Minute	700°C	N2	15 lpm
	2.5"/Minute	RT	N2	15 lpm

Caution: Anytime BoronPlus sources are exposed to temperatures above 600°C,
silicon wafers should be placed between each pair of sources and at each end of the load to prevent warpage and/or breakage of the sources.

Special Instructions

SI 1

The gas flow rate recommended is based on experience with a variety of different systems. Some customers have found that increasing the gas flow rate during insertion and withdrawal will further decrease the chances of moisture backstreaming from the mouth of the furnace. This technique is particularly useful if only an end plate is used to cover the cap of the furnace, or if the end cap is loose fitting.

SI 2

Initially, the indicated percentage of oxygen should be blended into the carrier gas for the initial series of tests. Eventually, the oxygen concentration that produces acceptable results for your process should be selected. Normally, this will be between 0.5% and 5%. The PhosPlus sources are not affected by oxygen.

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SI 3

Variations in the humidity level of plant air could cause variations in sheet resistivity. To reduce the effects of moisture, the following steps are recommended:

- After predeposition, cool the silicon and sources in dry nitrogen.
- When not in use, always store the sources in dry nitrogen at an elevated temperature.

Diffusion Carrier Design

Insure that the PhosPlus sources are loose in their slots. Tight slots can result in breakage of the sources. Slot dimensions and carrier fabrication dimensions can be found in Product Bulletin Carrier Design. The BoronPlus and PhosPlus sources have the same dimensions, permitting the same boat design to be used for both types of sources.

Cleaning

As part of the routine cleaning process, PhosPlus sources are acid etched to remove any foreign matter and to expose a pristine surface. As a result, no additional cleaning is necessary before putting the sources into the diffusion furnace. If your facility requires in-plant cleaning, the following procedures are the only ones recommended for PhosPlus sources:

- 15 seconds in dilute acid at room temperature.
- TP-250 4:1 HN03 / TP-470 10:1 HF
- 2 minute rinse in fresh DI water.
- 1 minute rinse in fresh DI water.
- Air dry in a clean hood for 60 minutes.
- Store in nitrogen.

These procedures are only recommended for initial cleaning. If the sources become contaminated after aging, contact your area technical representative for assistance. Additional information on cleaning can be found in Product Bulletin Cleaning PhosPlus.

Consult your plant safety office or the chemical manufacturer for information on the safe handling of any cleaning agents or other materials referred to above.

Aging

Before using PhosPlus sources in production for the first time, an initialization or aging period is required. This insures that all moisture has been vaporized, and it enables the sources to achieve a constant rate of phosphorus evolution. Aging should take place at the predeposition temperature in nitrogen with 25 - 50% oxygen and may last from a few hours for high temperature processes to as long as 24 hours for low temperature processes. See Product Bulletin Aging for additional information on aging

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Remember that PhosPlus sources are not sensitive to oxygen. You may, therefore, tailor the oxygen concentration in your carrier gas to produce the best results for your devices.

Caution: Anytime BoronPlus sources are exposed to temperatures above 600°C, silicon wafers should be placed between each pair of sources and at each end of the load to prevent warpage and/or breakage of the sources.

Storage

Appropriate storage procedures should be followed to protect PhosPlus sources from unnecessary exposure to moisture. Proper storage will contribute to increased uniformity and long life of the sources and will improve the electrical properties of your devices.

For dedicated diffusion tubes, we recommend that PhosPlus sources be stored in the hot zone of the tube near 600°C. Sufficient dry nitrogen should flow through the tube so that no backstreaming will reach the sources.

In those cases where the diffusion furnace is used for other processing steps, or is somehow not suitable for storing PhosPlus sources, the PhosPlus sources should be stored in an oven at a temperature above about 200°C. The oven must be continuously purged with dry nitrogen flowing at a rate sufficient to prevent room air from entering the storage chamber.

When the sources are stored in room air or accidentally left in room air for a considerable period of time, sufficient moisture might be adsorbed to affect their performance during the following run. Their performance can be easily restored, however, by inserting the sources into the diffusion tube at the insertion temperature for about 15 minutes. When they are withdrawn from the tube, the boat is ready for loading with production silicon. Additional information on storage can be found in Product Bulletin Storage.

References

Carbone, T., “Solid-Source Doping of a Double Polysilicon Capacitor,” Semiconductor International, Nov. (1997), pp. 89-95.

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