

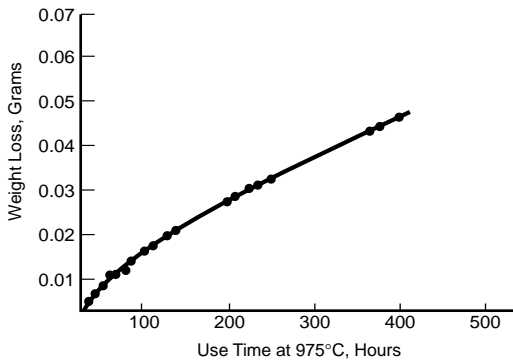
Source Preparation: Aging

Introduction

Initialization of the BoronPlus and PhosPlus sources is a necessary step in their preparation for use in production. Although the sources have an indefinite shelf life, it is recommended that the sources be aged at the predeposition temperature before the first production run. This will insure that the sources are evolving B₂O₃ or P₂O₅ at a uniform rate, that all moisture is vaporized, and that any residual cutting and cleaning solutions are oxidized.

The shape of a typical weight loss curve for a BoronPlus source (Figure 1) indicates that a B₂O₃ concentration gradient develops from the interior of the source to its surface during use and that the B₂O₃ is evolving from the source at a diffusion-controlled evolution rate. Although this results in the BoronPlus sources evolving B₂O₃ at a high rate when they are new, the rate falls off exponentially and quickly becomes relatively constant with continued use time. A similar P₂O₅ evolution rate occurs with new PhosPlus sources. Therefore, for optimum results, the sources should not be used in production until the relatively constant evolution rate has been established. This bulletin gives the recommended procedures that will develop this evolution rate and that will properly prepare the sources for use in production.

Figure 1: Weight Loss of BoronPlus Sources



Aging Procedures

It is recommended that the BoronPlus and PhosPlus sources be aged at the predeposition temperature prior to the first production run using the following procedures:

1. Place the dopant sources into the diffusion boat in the normal production configuration. One dummy silicon wafer should be placed between each pair of sources for the purpose of conducting heat.
2. Adjust the nitrogen gas flow rate to the rate that will eventually be used in the production runs. The gas should contain about 25% oxygen to oxidize all residual organic residues that may have been left behind from the cutting and cleaning operations.
3. Insert the loaded carrier into the diffusion furnace and ramp the furnace to the aging temperature (same as the intended predeposition temperature) using the procedures outlined in Product Bulletin 510.

Figure 2: Recommended Minimum Aging Time For BoronPlus Sources

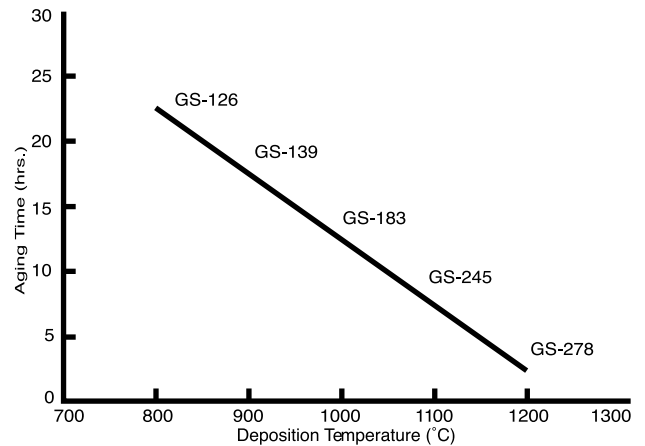
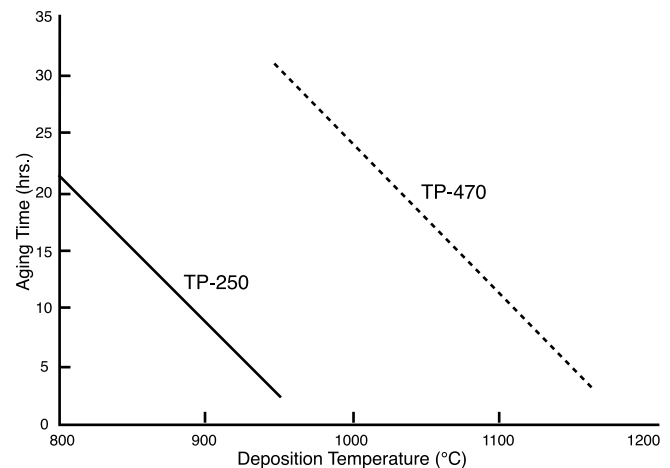


Figure 3: Recommended Minimum Aging Time For PhosPlus Sources



4. Hold the sources at the aging temperature for the minimum aging times suggested in Figure 2 for the BoronPlus sources and in Figure 3 for the PhosPlus sources. If longer aging times are desired, the above steps can be repeated with or without the oxygen in the nitrogen.
5. At the end of the aging period, replace the dummy silicon wafers with production silicon wafers or store the boat until needed (see Product Bulletin 514)

Once this initial aging process has been completed, no additional aging cycles are necessary. The boatload of sources is now ready to be placed into production, and it can be run continuously at the aging temperature (now the predeposition temperature) until the diffusion engineer has determined that the sources have reached the end of their useful life.

If it is desired to use a set of BoronPlus or PhosPlus sources at a significantly higher or lower predeposition temperature (generally, more than about 50°C), the aging cycle should be repeated at the new temperature. This will establish a different B₂O₃ concentration gradient within the BoronPlus sources that is characteristic of the new temperature. Repeating the aging cycle for the PhosPlus sources also insures that they are evolving P₂O₅ at a constant rate characteristic of the new temperature of use.

Conclusion

Aging is a necessary and important step in the preparation of the dopant sources for use in production. The suggestions in this bulletin will help to insure that the optimum performance of the sources will be obtained in the production of semiconductor devices.

For more information on this Product Bulletin or on the BoronPlus and PhosPlus dopant sources, contact the Planar Dopants Team: www.techneglas.com

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