

Wafer Handling Apparatus and Method

Technical Field

This invention relates to methods and apparatus for handling semiconductor wafers.

5 Background of the Invention

It is common during the manufacture of semiconductor integrated circuit chips to process semiconductor wafers with steps such as etching, deposition, etc., and then ship the processed wafers to a remote location for dicing and packaging. Wafers which are shipped to remote packaging operations are commonly packed
10 manually in wafer jars. (A wafer jar is denoted by reference numeral 11 of FIG. 1.) When packing wafers into a wafer jar, an operator, may use a device termed "wafer dealer" to present the wafers to him one at a time. Alternatively, the operator may select wafers manually. Then the operator picks up each wafer, either with a vacuum wand or a gloved hand and places the wafer in the wafer jar. A paper disc is placed
15 between each wafer. Typically, a wafer jar may hold 1-25 wafers. A lid is placed upon the wafer jar after it has been filled with wafers.

When the wafers arrive at the remote packaging location, the wafers are unpacked by removing the jar lid and turning the jar upside down on a table and emptying its contents upon the table. This process of emptying the jar presents both
20 contamination and breakage hazards.

Those concerned with the advancement of semiconductor integrated circuit manufacturing technology have consistently sought better and more reliable methods of wafer handling. There exists wafer handling equipment which utilizes a vacuum wand to hold the wafer by suction on its backside. However, such a vacuum
25 wand is not capable of safely loading a wafer jar because the wand would be required to drop the wafer into the jar from the top. Alternatively, operators use tweezers to grasp wafers by the edge. However, this method is unsuitable for loading a wafer jar.

Summary of the Invention

30 Wafer handling may be facilitated by the present invention which illustratively, includes a wafer jar insert having a round base for supporting the wafers and at least one arm rigidly extending upward from the base.

In an illustrative embodiment, the invention comprehends a plurality of arms extending upward from the base. A plurality of wafers may rest upon the base
35 and may be closely received by the arms.

Alternatively, another embodiment is a method of integrated circuit manufacturing including the placing of a plurality of wafers into a wafer jar insert and then the placing of the wafer jar insert into a wafer jar.

Further illustrative embodiments include opening the wafer jar;
5 removing a wafer jar insert from the wafer jar; and removing at least one wafer from the wafer jar insert.

Another embodiment also includes an apparatus for the manufacture of integrated circuits including a wafer jar insert for holding wafers; a tube having a vacuum chuck adapted for holding a wafer face; and means for controlling
10 empowering the tube whereby the tube places wafers within the wafer jar insert and then releases the wafers.

Brief Description of the Drawing

FIGS. 1 and 2 are perspective views of illustrative embodiments of the present invention; and

15 FIG. 3 is a perspective view of an alternative embodiment of the invention.

Detailed Description

Illustratively, the present invention encompasses a wafer jar insert; method of handling said insert; and method and apparatus for loading wafers into
20 said insert. In FIG. 1, reference numeral 11 denotes a wafer jar commonly used in the semiconductor industry. For example, a representative wafer jar is model Wafercon 2100 manufactured by Semiconductor Products Inc., 724 Aldo Avenue, Santa Clara, California 95054. Reference numeral 13 denotes a processed semiconductor wafer. It is desired to safely load (and subsequently unload) a
25 plurality of wafers 13 into wafer jar 11. Illustratively, in the present invention, wafers 13 are first placed (either mechanically or by hand) into wafer jar insert 15. When wafer jar 15 is filled (or partially filled) with wafers, wafer jar insert 15 together with its wafer load is placed within wafer jar 11.

Wafer jar insert 15 has a generally flat round base 17. Indentations or
30 cut-outs within base 17 are permissible. Extending upward from base 17 is a plurality of arms 19. There is no requirement for a precise number of arms. Only one arm would suffice if it were sufficiently rigidly attached to base 17. Three arms might be considered minimal in some circumstances to assure containment of wafers within wafer jar insert 15. The embodiment of FIG. 1 shows four arms 19. Each
35 arm 19 has an upward extending portion 21 preferably rigidly attached to base 17. Portion 21 may exhibit a slight curvature consistent with its attachment to the round periphery of base 17. Ears 23 are (optionally) positioned atop upward extending

portion 21 to facilitate manual or mechanical handling of the insert 15. Other features for facilitating mechanical handling, such as hooks or loops extending inward or outward may also be utilized.

In manual operation, a plurality of wafers 13 is loaded into wafer jar insert 15. Then wafer jar insert 15, with its accompanying wafer load is placed into wafer jar 11. A lid is placed upon wafer jar 11 and the jar is shipped to a remote location. When wafer jar 11 arrives its destination, the lid is removed, the wafer jar insert 15 is grabbed by ears 23 and removed from wafer jar 11 together with its wafer load. There is no risk of breakage or contamination of the individual wafers. Individual wafers may then be removed or inspected from wafer jar insert 15.

An alternative packing procedure might include: loading wafer jar insert 15 manually; inverting wafer jar 11 over loaded wafer jar insert 15; placing the lid of wafer jar 11 beneath the inverted wafer jar, and in contact with base 17. In this procedure, removal of wafer jar 15 and its load is accomplished by simply lifting wafer jar 11 up away from wafer jar insert 15 at the remote location.

Wafer jar insert 15 is also ideally suited to machine loading and unloading. Shown in FIG. 2 is vacuum chuck 53 connected to tube 51. Vacuum chuck 53 grasps wafer 13 on its underside. Tube 51 rotates, thereby inverting wafer 13. Tube 51 then lowers wafer 13 into wafer jar insert 15. Tube 51 fits between upward extending portions 21 without interference. Thus, it can be seen that the use of wafer jar insert 15 permits mechanical loading of wafers 13 ultimately into wafer jar 11 which could not otherwise be accomplished. Unloading may be performed by simply reversing the above process. In other words, wafer jar insert 15, together with its wafer load is removed from wafer jar 11 and then a tube with a vacuum chuck unloads each wafer.

The same tube and vacuum chuck or an additional one might provide interleaved pieces of paper.

Tube 51 is controlled and powered by apparatus 81 easily designed by those of skill in the art.

In Fig. 3, insert 151 has round base 171. One wraparound arm 151 extends upward from base 171 and encircles base 171. Opening 191 permits lowering of wafers by vacuum chuck 53 and tube 51.



The invention claimed is:

1. An apparatus for holding semiconductor wafers comprising:
a wafer jar insert 15 having a base 17 for supporting said wafers;
at least one arm 19 rigidly extending upward from said base 17.
- 5 2. The apparatus of claim 1 further including a cylindrical jar 11
dimensional to closely receive said wafer jar insert.
3. A wafer jar insert comprising:
a round base 17;
a plurality of arms 19 extending upward from said base: whereby a
10 plurality of wafers may rest upon said base 17 and be closely received by said arms
19.
4. The wafer jar insert of claim 3 further including at least one ear 23 per
arm.
5. A method of semiconductor integrated circuit manufacturing
15 comprising:
placing a plurality of wafers 13 into a wafer jar insert 15;
placing said wafer jar insert 15 into a wafer jar 11.
6. The method of claim 5 further including the steps of transporting said
wafer jar.
- 20 7. A method of semiconductor integrated circuit manufacturing
comprising:
opening a wafer jar 11;
removing a wafer jar insert 15 from said wafer jar 11;
removing at least one wafer 13 from said wafer jar insert 15.
- 25 8. The method of claim 7 further including the step of dicing said wafer
13.
9. An apparatus for manufacturing semiconductor integrated circuits
comprising:



a wafer jar insert 15 for holding wafers 13;

a tube 51 having a vacuum chuck 53 adapted for holding a wafer 13

face:

means 81 for controlling and powering said tube whereby said tube

5 places wafers within said wafer jar insert and then releases said wafers.



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