

IMPROVED DRY BLOCK ASSEMBLY

Field of the Invention

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The invention relates to the dicing of integrated circuits from a substrate. In particular, the invention relates to downstream stages from the dicing station with specific application to the assembly for the dry block.

10 Background

Machines used for the dicing of integrated circuits (IC) from substrates comprise an integrated set of stages from loading to dicing of the substrate and subsequently washing and then unloading of the individual IC units.

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Between the cleaning and unloading stages is the drying stage whereby the IC units having been washed need to be dry so as to remove all moisture from the IC units.

In the past, substrates tended to be reasonably large having large IC units. This allowed
20 for large apertures through which a vacuum source sealed each individual unit. The IC units were easily engaged using normal air pressure because of the large apertures and the large surface area applied to the units leading to a large engagement force.

Metal surfaces were preferred for the dry block as compared to other stages in the process which incorporated rubber layers. Rubber for the dry block was inappropriate as the increased heat to remove moisture from the IC units distorted the rubber and so prevented a vacuum seal with the units.

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As the IC units became smaller, due to developments within the semi-conductor industry, the apertures providing the vacuum seal became correspondingly smaller and so applied a smaller engagement force to each individual unit. However, the external factors leading to the loss of vacuum seal remain. Such sources of pressure leakage
10 include:

- (i) misalignment of the individual IC units;
- (ii) poor mould compound as substrate manufacturers sought to save money on materials;
- 15 (iii) warpage within the substrate leading to non-planar IC units and;
- (iv) laser markings on the mould compound which can lead to a small gap through the mould compound and so providing an avenue of leakage.

Whilst most of these issues have always existed, they have only manifested as a serious
20 impediment to the arrangement of the dry block as the loss of engagement force through vacuum has dropped with the decrease in IC unit size.

At different stages within the IC unit processing device, the issues of pressure leakage is largely avoided through the use of a rubber layer. Variation in the tolerance between

the IC unit and the rubber layer is accommodated by the resilient nature of the rubber. As mentioned, given the heat applied at the dry block stage, warping of a rubber layer renders the use of a rubber layer with the dry block, as used in other stages, impractical.

5 Summary of Invention

In a first aspect the invention provides a dry block assembly for receiving a plurality of IC units, comprising: a support plate; a rubber layer having an array of vacuum apertures, each aperture arranged to receive an IC unit thereon; a locking device for
10 fixing the rubber layer onto the support plate; wherein the rubber layer is arranged into sections having sub-arrays of apertures, adjacent sections separated by expansion voids.

Consequently, by providing a rubber layer having expansion voids, the application of heat to the dry block will still expand the rubber; however the rubber having the
15 expansion voids permits the rubber to expand without leading to a distortion of the layer. Thus, whilst the rubber layer may be clamped securely into a steel block, the boundary conditions of the clamping do not prevent expansion into the expansion voids. Thus, maintaining a reliable seal between the IC units and the dry block are provided by the rubber.

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In one embodiment, apertures in the rubber layer corresponding to the IC units may be significantly larger than conventional apertures. For instance, the apertures may be in the range 50% to 95% of the engagement face of the IC unit. By providing a larger aperture, the vacuum force upon each IC unit is increased. As the rubber layer is not a

structural component of the dry block, increasing the size of the aperture is achievable as compared to a steel block. By increasing the aperture size the structural integrity of the steel dry block may reduce. The large number of IC units engaged with the dry block may lead to a significant loss of material, and therefore strength, of the steel block.

5 Because the rubber layer overlays the steel block, the aperture size of the underlying steel block can remain small with the force applied to the IC unit determined by the larger aperture of the rubber layer. Further, the larger aperture in the rubber layer may reduce water marks developed by moisture trapped between the rubber layer and the IC unit. Unlike steel blocks, where the heat transfer characteristic is much higher and so
10 contact between the IC unit and the steel block can remove entrapped moisture, rubber blocks tend to trap moisture more easily but make removal much harder. A larger aperture size may consequently reduce the contact area and so reduce water marks.

Brief Description of Drawings

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It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the accompanying drawings is not to be understood as superseding the generality of the
20 preceding description of the invention.

Figure 1 is an isometric view of a dry block according to one embodiment of the present invention;

Figure 2 is an exploded view of the dry block of Figure 1;

Figures 3A and 3B are various isometric views of a rubber layer according to one embodiment of the present invention;

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Detailed Description

Figures 1 and 2 show a dry block assembly 5 according to one embodiment of the present invention.

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The dry block assembly 5 comprises a steel support block 10 having a recess into which a rubber layer 15 fits. Apertures 30 in the rubber layer 15 correspond to apertures 12 in the underlying steel block 10. A bracket 20 is arranged to engage with a lip 25 in the rubber layer with the bracket 20 bolted into the underlying steel block 10. The bracket
15 is arranged to hold the rubber layer 15 in place and act as a fixed boundary condition around the outside of the rubber layer.

Figures 3A and 3B show a close up view of the rubber layer 15, divided into sections 40. In this case the rubber layer is divided into nine sections 40, each having a sub-array of
20 apertures corresponding to the IC units to be placed thereon. The sections are divided into external sections and internal sections. The external sections have at least one external edge, that is, at least one peripheral edge forming a portion of the peripheral edge of the rubber layer. The remainder are internal edges, that is, only peripheral edges which lie wholly within the rubber layer. . The internal sections have only internal edges.

That is, the internal sections are bounded along each peripheral edge by other sections. It will be appreciated that, whilst the arrangement of the Figures have eight external sections and only one internal section, there may be several internal sections, having larger or smaller sub-arrays of apertures.

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The apertures may include a recess into which the IC units fit with the recess having an aperture 30 corresponding to at least 50% and up to 95% of the area of the recess so as to maximize the engagement force applied to the IC unit and minimize the contact surface between the IC unit and the rubber layer. Said aperture size may be 80% of the
10 area of the recess.

Of critical importance is the separation of the various sections 40 by an expansion void or groove 35 which provides a tolerance between the portions. On expansion 45 the portions expand towards each other as compared to a solid rubber layer which would
15 have no opportunity for expansion and therefore warped within the boundary layer provided by the bracket 20.

The depth of the groove 35 may be full depth of each section 40 with each section 40 secured to a support layer. In this case, lip 25 used to clamp the rubber layer 15 may be
20 an extension of the support layer. Thus, the sections 40 are separate members within the rubber layer with expansion 45 only restricted by the point of contact with the underlying layer 25.

In the arrangement shown in the Figures, the expansion void, or groove 35, is placed only along internal edges, and so all expansion is directed inwards. It will be appreciated that the grooves 35 may also be placed along the external edges, and so permitting expansion both inwards and outwards.

Claims

1. A dry block assembly for receiving a plurality of IC units, comprising:
 - a support plate;
 - 5 a rubber layer having an array of vacuum apertures, each aperture arranged to receive an IC unit thereon;
 - a locking device for fixing the rubber layer onto the support plate;
 - wherein the rubber layer is arranged into sections having sub-arrays of apertures, adjacent sections separated by expansion voids.
- 10 2. The dry block assembly according to claim 1, wherein the expansion voids include grooves.
3. The dry block assembly according to claim 1 or 2, wherein the rubber layer
 - 15 includes external sections, having at least one external edge defining a portion of an external edge of the rubber layer, such that the expansion voids are also placed along said external edges.
- 20 4. The dry block assembly according to any one of claims 1 to 3, wherein the support plate includes apertures corresponding to the vacuum apertures of the rubber layer.

5. The dry block assembly according to any one of claims 1 to 3, wherein the support plate includes a manifold in vacuum communication with the vacuum apertures of the rubber layer.
- 5 6. The dry block assembly according to any one of claims 1 to 5, wherein each vacuum aperture includes a respective recess and arranged such that the IC unit fit in said recess.
7. The dry block assembly according to claim 4, wherein the vacuum apertures are
10 substantially larger than the apertures of the support plate.
8. The dry block assembly according to claims 6 or 7, wherein each vacuum aperture has an area in the range 50 to 95% of the area of the recess.
- 15 9. The dry block assembly according to claim 7 or 8, wherein each vacuum aperture has an area of 80% of the area of the recess.
10. The dry block assembly according to any one of claims 1 to 9, wherein the rubber layer is mounted to the support plate by a clamping bracket, said
20 clamping bracket arranged to engage a lip peripherally extending from said rubber layer.