WAFER CONTAINER WITH PARTICLE SHIELD

RELATED APPLICATION

This application claims the benefit of U.S. Provisional Patent Application No. 61/482,151, filed on May 3, 2011, the disclosure of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Controlling particles and other contaminants has always been of paramount importance in semiconductor processing. As such, wafers that are processed into integrated circuits are stored and transported in enclosed environments, typically front opening boxes, sometimes known as FOUPS (front opening unified pods) and FOSBS (front opening shipping boxes). These wafer containers hold the wafers in spaced stacked arrays and have sealable doors that may be robotically opened. The containers also have features permitting conveyance and robotic access to the wafers. As the circuit sizes have decreased, the importance of the integrity of the wafer containment environment has increased. In advanced semiconductor processing, particularly 40nm and below, moisture control of the wafers at or below 10 % or 5% relative humidity ("RH") has been found to be very beneficial or critical for desired integrated circuit yields. To control moisture inside the wafer carriers that transport and store wafers gas purge, such as nitrogen, is utilized to replace the ambient atmosphere.

SUMMARY OF THE INVENTION

According to a first aspect, there is provided a wafer container with enhanced particle protection comprising a container portion with an open front and a door sized to close the open front, the container portion having a top with a top wall, a pair of sidewalls, a backside with a backside wall, and a bottom with a three groove kinematic coupling outwardly exposed, the top wall, the sidewalls, the backside wall, the bottom defining an open interior, the container portion further comprising two sets of opposing shelves located in the open interior at each side of the container portion defining a plurality of slots, including an uppermost slot, for receiving wafers through the open front, the wafer container further comprising a robotic flange extending upwardly from the container

portion at the top of the container portion, the wafer container further comprising a particle shield configured generally as a flat plate, the particle shield attached to the container portion in the open interior at the top of the container portion opposite the robotic flange and spaced from the top wall, thereby collecting particles generated at the top wall and preventing them from falling on a wafer in the uppermost slot.

According to a second aspect, there is provided a method of providing enhanced particle protection in a wafer container comprising: providing a purge to a front opening wafer container to a relative humidity in the wafer container below 5%; transporting the wafer container by way of a robotic flange on the top of the wafer container whereby particles are generated at the top of the wafer container in the interior of the wafer container; providing a barrier between the uppermost wafer in the wafer container and the top of the wafer container by positioning a particle shield therebetween and supporting the wafer shield by the wafer container.

According to a third aspect, there is provided a wafer container with enhanced particle protection comprising a container portion with an open front and a door sized to close the open front, the container portion having a top with a top wall, a pair of sidewalls, a backside with a backside wall, and a bottom with a three groove kinematic coupling outwardly exposed, the top wall, the sidewalls, the backside wall, the bottom defining an open interior, the container portion further comprising two sets of opposing shelves located in the open interior at each side of the container portion defining a plurality of wafer slots, including an uppermost wafer slot, for receiving wafers through the open front, the wafer container further comprising a robotic flange extending upwardly from the container portion at the top of the container portion, the wafer container further comprising a particle shield positioned intermediate the uppermost wafer slot and the top wall and positioned below the robotic flange, the particle shield providing a barrier to prevent particles originating at the top wall from falling onto a wafer in the uppermost wafer slot.

According to a fourth aspect, there is provided a method providing enhanced particle protection to wafers in a wafer container comprising: maintaining a low RH of less that 10% in the wafer container for more than 30 minutes and controlling particles that are present or emitted at the top interior of the container by providing a removable particle

shield between the top wall of the wafer container and stack of wafers, said barrier substantially overlaying an uppermost wafer.

According to a fifth aspect, there is provided a method of providing enhanced particle protection to wafers in a wafer container comprising: insertion of a particle shield in a slot at the top of a front opening wafer container; passing air or gas through opening in the particle shield that then creates a charge in the particle shied for attracting particles; and attracting particles with said charge to be adhered to the particle shield.

According to a sixth aspect, there is provided a wafer container with enhanced particle protection comprising a container portion with an open front and a door sized to close the open front, the container portion having a top with a top wall, a pair of sidewalls, a backside with a backside wall, and a bottom with a three groove kinematic coupling outwardly exposed, the top wall, the sidewalls, the backside wall, the bottom defining an open interior, the container portion further comprising two sets of opposing shelves located in the open interior at each side of the container portion defining a plurality of slots, including an uppermost slot, for receiving wafers through the open front, the wafer container further comprising a robotic flange extending upwardly from the container portion at the top of the container portion and a pair of purge ports for purging the wafer container, the wafer container further comprising a particle shield configured generally as a flat plate having a plurality of openings thereon, the particle shield attached to the container portion in the open interior at the top of the container portion opposite the robotic flange and spaced from the top wall and space from the uppermost slot and sized to substantially shield a wafer in the uppermost slot from the top wall, thereby collecting particles originating at the top wall and substantially preventing them from falling on the wafer in the uppermost slot.

According to a seventh aspect, there is provided a method providing enhanced particle protection to wafers in a wafer container during transport by way of a robotic flange on the top of the wafer container, the method comprising: maintaining a low RH of less that 10% in the wafer container for more than 30 minutes and controlling particles that are present or emitted at the top interior of the container by providing a removable particle shield placed between the top wall of the wafer container and a stack of wafers in the wafer container, said barrier substantially overlaying an uppermost wafer of the stack of wafers.

Maintaining the wafer containment environment below 5% RH in FOUPS and FOSBS has been discovered to create particulate problems, particularly relating to the top wafer in the spaced stacked arrays, and particularly during transporting FOUPS by their robotic flange located on the top of FOUPS. Means to provide enhanced particulate control, particularly in applications where less that about 5% RH is maintained.

A particulate shield positioned above the top wafer in wafer containers such as FOUPS may be provided to prevent accumulation of particulates on wafers. The particulate shields or barriers may be formed of materials that are compatible to maintaining less than 5% RH, particularly materials that will not absorb meaningful