Claims:

1. A UV lamp assembly for a degas chamber comprising a plurality of parallel UV lamps and rotary shutters, each rotary shutter comprising a concave wall surrounding a UV lamp and two flanges extending outwardly and bend away from longitudinal edges of the concave wall, the rotary shutters configured to rotate between an open position and a closed position, wherein the rotary shutters at the open position are arranged above the UV lamps so as to reflect UV light of the UV lamps into the degas chamber without blocking UV light of the UV lamps from passing into the degas chamber; and the rotary shutters at the closed position, at which the flanges of adjacent rotary shutters overlap to prevent UV light leakage, are arranged below the UV lamps so as to block UV light of the UV lamps from passing into the degas chamber.

2. The UV lamp assembly of claim 1 wherein a concave surface of the concave wall is a reflective surface.

3. The UV lamp assembly of claim 1 wherein the concave wall is semi-cylindrical and each end of the concave wall is in a groove of a support member, the UV lamp assembly further comprising a drive mechanism operable to rotate the shutters between the open and closed positions.

4. The UV lamp assembly of claim 1 wherein the flanges of each rotary shutter are co-planar; have a width of about 0.07 to 0.09 inch; and longitudinal ends of the flanges are spaced at least about 0.1 inch from longitudinal ends of the concave wall.

5. The UV lamp assembly of claim 1 wherein the flanges of each rotary shutter overlap the flanges of an adjacent rotary shutter by about 0.03 to 0.05 inch at the closed position.

6. The UV lamp assembly of claim 1 further comprising:

a support block having a hole for each rotary shutter;

a spindle having a stem for each rotary shutter;

a drive mechanism; and

wherein:

the rotary shutter is attached to the spindle;

the stem of the spindle is rotatably supported in the hole of the support block; and

the stem of the spindle is driven by the drive mechanism such that the attached rotary shutter is rotatable between the open and closed positions.

7. The UV lamp assembly of claim 1, wherein each UV lamp comprises a pair of parallel cylindrical tubes bonded together.

8. The UV lamp assembly of claim 1, comprising four UV lamps having a first length and two UV lamps having a second length at least 10% shorter than the first length, the four longer length lamps located between the two shorter length lamps, the rotary shutters on the six lamps being operated simultaneously.

9. A degas chamber comprising the UV lamp assembly of claim 1 wherein ozone or oxygen gas removes halogen-containing residues from a semiconductor substrate supported in the degas chamber.

10. A degas chamber of claim 9 wherein interior surfaces of the degas chamber exposed to UV light of the UV lamp assembly are blackened to reduce reflection of UV light and the UV light decomposes the ozone gas or oxygen into oxygen radicals which react with the halogen-containing residues on the semiconductor substrate and gaseous reaction products are evacuated from the degas chamber by a vacuum pump.

11. A method of processing a semiconductor substrate using the degas chamber of claim 9, comprising:

rotating the rotary shutters to the closed position;

transporting a semiconductor substrate into the degas chamber;

rotating the rotary shutters to the open position;

supplying ozone gas or $O_2$ gas into the degas chamber while maintaining a vacuum pressure in the chamber of 10 mTorr to 10 Torr;

generating O radicals by irradiating the ozone gas or $O_2$ gas in the degas chamber through a quartz window with UV light;

removing halogen-containing residues on the semiconductor substrate by reaction with the O radicals;

rotating the rotary shutters to the closed position;

removing the semiconductor substrate from the degas chamber.

12. The UV lamp assembly of claim 1, wherein one end of each rotary shutter is attached to an annular shutter support and an opposite end is attached to a stemmed shutter support, the annular shutter support and stemmed shutter support rotatably mounted in cylindrical recesses of opposed bearing blocks, and a drive mechanism connected to each stemmed shutter support moves the rotary shutters between the open and closed positions.

13. The UV lamp assembly of claim 1, wherein an end of each rotary shutter is attached to an annular bearing and a drive spindle having a stem and center hole, a UV lamp of the lamp assembly passing through a center hole of the bearing and the bearing rotatably mounted in a cylindrical recess in an inner surface of a socket plate.

14. The UV lamp assembly of claim 1, wherein cantilevered drive arms are fixedly attached to stems of drive spindles attached to the rotary shutters and ends of the drive arms are rotatably attached to linkage which moves laterally back and forth to open and close the rotary shutters.

We Claim:

1. A UV lamp assembly for a degas chamber comprising a plurality of parallel UV lamps and rotary shutters, each rotary shutter comprising a concave wall surrounding a UV lamp and two flanges extending outwardly from longitudinal edges of the concave wall, the rotary shutters configured to rotate between an open position and a closed position, wherein the rotary shutters at the open position are arranged above the UV lamps so as to not block UV light of the UV lamps from passing into the degas chamber; and the rotary shutters at the closed position, at which the flanges of adjacent rotary shutters overlap to prevent UV light leakage, are arranged below the UV lamps so as to block UV light of the UV lamps from passing into the degas chamber.

2. The UV lamp assembly of claim 1 wherein a concave surface of the concave wall is a reflective surface.

3. The UV lamp assembly of claim 1 wherein the concave wall is semi-cylindrical.

4. The UV lamp assembly of claim 1 wherein the flanges of each rotary shutter are co-planar; have a width of about 0.07 to 0.09 inch; and longitudinal ends of the flanges are spaced at least about 0.1 inch from longitudinal ends of the concave wall.

5. The UV lamp assembly of claim 1 wherein the flanges of each rotary shutter overlap the flanges of an adjacent rotary shutter by about 0.03 to 0.05 inch at the closed position.

6. The UV lamp assembly of claim 1 further comprising:
a support block having a hole for each rotary shutter;
a spindle having a stem for each rotary shutter;
a drive mechanism; and

wherein:

the rotary shutter is attached to the spindle;

the stem of the spindle is rotatably supported in the hole of the support block; and

the stem of the spindle is driven by the drive mechanism such that the attached rotary shutter is rotatable between the open and closed positions.

7. The UV lamp assembly of claim 1, wherein each UV lamp comprises a pair of parallel cylindrical tubes bonded together.

8. The UV lamp assembly of claim 1, comprising four UV lamps having a first length and two UV lamps having a second length at least 10% shorter than the first length, the four longer length lamps located between the two shorter length lamps, the rotary shutters on the six lamps being operated simultaneously.

9. A degas chamber comprising the UV lamp assembly of claim 1.

10. A degas chamber of claim 9 wherein interior surfaces of the degas chamber exposed to UV light of the UV lamp assembly are blackened to reduce reflection of UV light.

11. A method of processing a semiconductor substrate using the degas chamber of claim 9, comprising:

rotating the rotary shutters to the closed position;

transporting a semiconductor substrate into the degas chamber;

rotating the rotary shutters to the open position;

supplying ozone gas or $O_2$ gas into the degas chamber while maintaining a vacuum pressure in the chamber of 10 mTorr to 10 Torr;

generating O radicals by irradiating the ozone gas or $O_2$ gas in the degas chamber through a quartz window with UV light;

removing halogen-containing residues on the semiconductor substrate by reaction with the O radicals;

rotating the rotary shutters to the closed position;

removing the semiconductor substrate from the degas chamber.