

and substrate 112 during processing. For example, the magnetic levitation system raises the support ring 130 and edge ring 164, which is supporting the substrate 112, above the window 120 and causes the raised components to rotate around a central axis 134. In certain embodiments, the support ring 130 may be disposed radially outside the window 120.

[0026] One or more pyrometers 140 are coupled to the chamber 100 through a chamber ceiling 128. One or more radiation collecting apparatuses 142, such as light pipes, extend through the ceiling 128 and are directed toward the substrate 112 to measure a temperature of the substrate 112. The radiation collecting apparatuses 142 are coupled to the pyrometers 140, which are further coupled to a controller 144. The controller 144 receives outputs of the pyrometers 140 and accordingly controls the voltages supplied to the heating apparatus 124. The pyrometers 140 generally measure light intensity in a narrow wavelength bandwidth of about 30 or 40 nm in a range between about 700 nm to about 1000 nm. The controller 144 converts the light intensity to a temperature through the Plank distribution of the spectral distribution of light intensity radiating from a black body held at that temperature. In this manner, temperature of the substrate 112 can be monitored during thermal processing.

[0027] Figure 2 is a schematic cross-sectional view of a thermal processing chamber 200 having a radiation shield 202 and absorbing surface 250 disposed therein according to one embodiment. A radiation shield 264 rests on a support ring 230 as described above with regard to Figure 1 and the radiation shield 264 is configured to support the substrate 112. A plurality of protrusions 208 extend from a portion 265 of the edge ring 264 which is disposed below the substrate 112. For example, three or four protrusions 208, such as pins or posts, contact and support the substrate 112 at discrete locations on a bottom surface of the substrate 112. It is believed that the minimal physical contact between the substrate 112 and the protrusions 208 reduce thermal discontinuity across the surface of the substrate 112 when compared to traditional edge rings which support the substrate 112 around

the entire circumference of the substrate 112. The protrusions 208 substantially prevent the edge ring 264 from acting as a heat sink which negatively affects temperature uniformity of the substrate 112 during thermal processing.

[0028] The edge ring 264 is made from a material which is substantially opaque and thus prevents the transmission of light through the edge ring 264. However, because the protrusions 208 separate the substrate 112 from the edge ring 264, light may propagate through the space between the substrate 112 and the edge ring 264 towards one or more pyrometers 240. This stray radiation, or background radiation, adversely affects the temperature measurement of the pyrometers 240 which are configured to measure the temperature of the substrate 112.

[0029] To prevent or reduce background radiation, the radiation shield 202 is disposed within the chamber 200. The radiation shield 202 is substantially ring-like and is made of a thermally stable opaque material, such as silicon carbide or the like. During thermal processing, the radiation shield 202 is supported by the edge ring 264 and at least a portion of the radiation shield 202 is disposed over a top surface of the substrate 112. The radiation shield 202 has an inner diameter 203 which is less than a diameter of the substrate 112. Thus, the radiation shield 202 extends over and above an outer portion of the substrate 112.

[0030] A first plurality of lift pins 204 are configured to contact the radiation shield 202 and raise the radiation shield 202 from the edge ring 264. The lift pins 204 extend through one or more voids 210 of the edge ring 264 sized to accommodate the lift pins 204. Although not shown, the lift pins 204 extend through the window 120 and the heating apparatus 124 and are coupled to an actuator, which is configured to move the lift pins 204 up and down along a vertical path. A second plurality of lift pins 206 are also provided in the chamber 200. The lift pins 206 are configured to engage the substrate 112 and support the substrate 112 during processing. The lift pins 206 are also

to a location on the ceiling 228 where the radiation collecting apparatus 242 is disposed, is greater than the first distance 406. The absorbing surface 250 may be disposed over a portion of or over the entire distance 404 on the interior surface 229 of the ceiling 228. In another embodiment, the radiation shield 202 is disposed a third distance 402 above the substrate 112. A fourth distance 408, measured from the interior surface 229 of the ceiling 228 to the substrate 112 in a processing position, is greater than the third distance 402. The spatial relationships between the radiation shield 202, ceiling 228, radiation collecting apparatuses 242 and pyrometers 240, and the substrate 112 provide for the reduction or elimination of stray background radiation being measured by the pyrometers 240.

[0040] Figure 5 is a schematic cross-sectional view of a thermal processing chamber 200 having a radiation shield 504 and absorbing surface 250 disposed therein according to one embodiment. The chamber 200 and components disposed therein are substantially similar to the chamber 200 and components described with regard to Figure 2. However, the radiation shield 504 is coupled to and supported by a third plurality of lift pins 502. The lift pins 502 are configured and function similarly to the lift pins 204 described with regard to Figure 2 and 3, but in this embodiment, the lift pins are 502 disposed radially outward of the support ring 230 and an edge ring 564. The radiation shield 504 extends from the lift pins 502 radially inward over the substrate 112 such that the inner diameter 203 of the radiation shield 504 is the same as the inner diameter 203 described with regard to Figure 2.

[0041] Figure 6 is a partial schematic cross-sectional view of the thermal processing chamber 200 of Figure 5 according to one embodiment. The distances 402, 404, 406 and 408 are similar to and described in greater detail with regard to Figure 4B. Here, the lift pins 502 are not disposed through the edge ring 564, which reduces the complexity of manufacturing the edge ring 564 and the necessity of the lift pins 204 to extend through the edge ring 564. For example, the edge ring 564 does not have voids formed therethrough to allow for passage of lift pins, which allows the edge ring 564 to more

Claims

1. An apparatus for reducing background radiation, comprising:
 - a chamber body defining a processing volume;
 - a radiation source coupled to the chamber body;
 - one or more pyrometers coupled to the chamber body opposite the radiation source;
 - a support ring disposed within the processing volume;
 - an edge ring disposed on the support ring; and
 - a radiation shield disposed above the edge ring, wherein an inner diameter of the radiation shield extends radially inward over a substrate support member of the edge ring and above a top most surface of the edge ring, and wherein the inner diameter of the radiation shield is less than an outer diameter of a substrate disposed within the chamber body.
2. The apparatus of claim 1, further comprising:
 - an absorptive coating disposed on the chamber body adjacent a region where the pyrometers are coupled to the chamber body.
3. The apparatus of claim 1, wherein a quartz window separates the processing volume from the radiation source.
4. The apparatus of claim 3, wherein the radiation source is coupled to the chamber body above the quartz window.
5. The apparatus of claim 1, wherein the edge ring and the radiation shield comprise a ceramic material.
6. The apparatus of claim 1, wherein the edge ring further comprises a plurality of discrete protrusions extending from a portion of the edge ring.

7. The apparatus of claim 1, wherein the edge ring further comprises a plurality of voids sized to allow passage of lift pins therethrough.
8. The apparatus of claim 2, wherein a first distance between an outer edge of a substrate and an inner edge of the radiation shield is less than a second distance between the inner edge of the radiation shield and a region on a ceiling of the chamber where the pyrometers are coupled to the chamber body.
9. The apparatus of claim 8, wherein a third distance between the radiation shield and the substrate is less than a fourth distance between the chamber ceiling and the substrate.
10. An apparatus for reducing background radiation, comprising:
a chamber body defining a processing volume;
a radiation source coupled to the chamber body, wherein a window separates the processing volume from the radiation source, and wherein the radiation source is coupled to the chamber body below the window;
one or more pyrometers coupled to the chamber body opposite the radiation source;
a support ring disposed within the processing volume;
an edge ring disposed on the support ring;
a radiation shield disposed above the edge ring, wherein an inner diameter of the radiation shield extends radially inward over a substrate support member of the edge ring and above a top most surface of the edge ring; and
an absorbing surface disposed on the chamber body adjacent a region where the pyrometers are coupled to the chamber body, the absorbing surface comprising a dielectric material selected to absorb or reflect radiation within a desired wavelength, wherein the inner diameter of the radiation shield is less than an outer diameter of a substrate disposed within the chamber body.

11. The apparatus of claim 10, wherein a first distance between an outer edge of a substrate and an inner edge of the radiation shield is less than a second distance between the inner edge of the radiation shield and a region on a ceiling of the chamber where the pyrometers are coupled to the chamber body.

12. The apparatus of claim 11, wherein a third distance between the radiation shield and a substrate is less than a fourth distance between the chamber ceiling and the substrate.

13. An apparatus for reducing background radiation, comprising:

- a chamber body defining a processing volume;

- a radiation source coupled to the chamber body, wherein a window separates the processing volume from the radiation source, and wherein the radiation source is coupled to the chamber body above the window;

- one or more pyrometers coupled to the chamber body opposite the radiation source;

- a support ring disposed within the processing volume;

- an edge ring disposed on the support ring; and

- an absorbing surface disposed on a bottom of the chamber body adjacent a region where the pyrometers are coupled to the chamber body, wherein the absorbing surface has a topology which directs radiation away from the pyrometers, and wherein an inner diameter of the absorbing surface is less than an outer diameter of a substrate disposed within the chamber body.