~~**What is claimed is:**~~

Claims

1.~~-~~ A method of detecting a vacuum leak comprising:

pumping a process chamber from a first pressure to a second pressure, wherein the second pressure is less than the first pressure;

enabling a spectral gauge;

closing a chamber isolation valve after pumping the process chamber to the second pressure;

collecting spectral data from a conduit using the spectral gauge for a sample time; and

calculating a chamber leak rate from the spectral data, wherein the chamber isolation valve is located in an exhaust conduit of the process chamber downstream of the spectral gauge and isolates the process chamber.

2.~~-~~ The method of claim 1, further comprising:

pumping the process chamber from the second pressure to a third pressure greater than the second pressure after collecting the spectral data; and

performing a substrate processing operation after pumping the process chamber to the third pressure.

~~3. The method of claim 1, wherein the chamber isolation valve is located in an exhaust conduit of the chamber downstream of the spectral gauge and isolates the process chamber.~~

~~4.~~ 3. The method of claim 1, wherein the collecting the spectral data is performed for about 15 seconds to about 100 seconds.

~~5.~~ 4. The method of claim 1, wherein the spectral data includes ~~the~~a concentration of oxygen, nitrogen, or both oxygen and nitrogen within the conduit.

~~6.~~ 5. The method of claim 1, wherein the chamber leak rate is calculated by comparing ~~a~~an intensity of gas concentration increase over time within the conduit to a pre-determined calibrated intensity of gas concentration increase over time.

~~7.~~ 6. The method of claim 1, wherein the second pressure is a predetermined pressure calculated during a calibration operation.

~~8.~~ 7. The method of claim 1, wherein the second pressure is ~~the~~a pressure at which a flow of foreline gases is lowest.

~~9.~~ 8. A method of processing a substrate comprising:

performing a leak detection test comprising:

pumping a process chamber to a leak test pressure;

enabling a spectral gauge;

closing a chamber isolation valve after pumping the process chamber to the ~~second~~leak test pressure;

collecting spectral data from a conduit using the spectral gauge for a sample time; and

calculating a chamber leak rate from the spectral data;

pumping the process chamber from the leak test pressure to a processing pressure greater than the leak test pressure after collecting the spectral data; and

performing a substrate processing operation on a number of substrates after pumping the process chamber to the processing pressure; and

repeating the performing a leak detection test.

~~10.~~ 9. The method of claim ~~9~~8, wherein the number of substrates comprises a plurality of substrates.

~~11.~~ 10. The method of claim ~~9~~8, wherein the leak detection test is performed in less than 300 seconds.

~~12.~~ 11. The method of claim ~~9~~8, wherein the leak detection test is performed at a temperature of greater than about 250 °C.

~~13~~12. The method of claim ~~9~~8, wherein the leak test pressure is about 20 mTorr to about 300 mTorr.

~~14.~~ 13. The method of claim ~~9~~8, wherein the spectral gauge measures radiation at a wavelength of about 250 nm to about 1000 nm.

~~15.~~ 14. A process chamber for processing a substrate comprising:

a chamber body defining a processing volume;

a process gas inlet;

a process gas outlet, the process gas outlet comprising:

a first conduit fluidly coupled between the processing volume and an exhaust pump;

a chamber isolation valve disposed between the processing volume and the exhaust pump; and

a spectral gauge fluidly coupled to the first conduit between the processing volume and the chamber isolation valve; and

a controller, the controller configured to:

pump the process chamber to a leak test pressure;

enable the spectral gauge;

close the chamber isolation valve after pumping the process chamber to the leak test pressure;

collect spectral data from the first conduit using the spectral gauge for a sample time; and

calculate a chamber leak rate from the spectral data.

~~16.~~ 15. The process chamber of claim ~~15~~14, further comprising:

a second conduit fluidly coupled between the first conduit and the spectral gauge; and

a gauge isolation valve disposed between the first conduit and the spectral gauge along the second conduit.

~~17.~~ 16. The process chamber of claim ~~15~~14, further comprising:

a process gas source;

a process gas conduit disposed between the process gas source and the process gas inlet; and

a reference leak device fluidly coupled to the process gas conduit between the process gas source and the process gas inlet.

~~18.~~ 17. The process chamber of claim ~~17~~16, wherein a reference leak isolation valve is disposed between the reference leak device and the process gas conduit.

~~19.~~ 18. The process chamber of claim ~~15~~14, wherein a vacuum gauge is fluidly coupled to the first conduit between the chamber isolation valve and the processing volume.

~~20.~~ 19. The process chamber of claim ~~15~~14, wherein the spectral gauge is an optical emission spectrometer.

20. A method of detecting a vacuum leak comprising:

pumping a process chamber from a first pressure to a second pressure, wherein the second pressure is less than the first pressure;

enabling a spectral gauge;

closing a chamber isolation valve after pumping the process chamber to the second pressure;

collecting spectral data from a conduit using the spectral gauge for a sample time;

calculating a chamber leak rate from the spectral data;

pumping the process chamber from the second pressure to a third pressure greater than the second pressure after collecting the spectral data; and

performing a substrate processing operation after pumping the process chamber to the third pressure.