CLAIMS

1. A method of detecting an anomalous plasma event in a semiconductor processing chamber, the method comprising:

detecting an optical signal emitted by a plasma in the semiconductor processing chamber, wherein the plasma is formed in response to an RF signal from an RF generator;

converting the optical signal to form an analog ~~a~~ voltage signal;

~~adjusting~~filtering the analog voltage signal to form an adjusted analog voltage signal;

~~determining~~comparing the adjusted analog voltage signal with the analog voltage signal to determine whether changes associated with the adjusted analog voltage signal exceed a threshold; and

adjusting, based at least in part on the determination, an output parameter of the RF signal from the RF generator.

2. The method of claim 1, wherein:

~~the adjusting~~filtering the analog voltage signal to form the adjusted analog voltage signal comprises filtering the analog voltage signal with a low-pass filter, ~~and~~

~~the determining comprises comparing the changes of the voltage signal to the adjusted voltage signal~~.

3. The method of claim 2, further comprising: ~~wherein the adjusting the voltage signal to form the adjusted voltage signal further comprises~~ applying an offset to the ~~adjusted~~analog voltage signal, wherein the offset analog voltage signal is filtered to form the adjusted analog voltage signal.

~~4. The method of claim 1, wherein the adjusting the voltage signal to form the adjusted voltage signal comprises taking a first derivative of the voltage signal.~~

~~5~~4. The method of claim 1, wherein the adjusting of the output parameter of the RF generator comprises lowering an output power of the RF generator from a first power level to a second power level.

~~6~~5. The method of claim ~~5~~4, further comprising:

maintaining, after lowering the output power of the RF generator from the first power level to the second power level, the output power of the RF generator at the second power level for a first time period; and

after the maintaining, increasing the output power of the RF generator from the second power level to the first power level for a second time period.

~~7~~6. The method of claim 1, further comprising:

determining, based at least in part on light intensity within the semiconductor processing chamber or process parameters, a first amount of RF power reduction;, and

reducing an output power level of the RF generator by the first amount,

wherein

the process parameters include one or more process parameters selected from the group consisting of: DC power level, RF bias power level, station-to-station RF power variations, frequency tuning parameters, pressure, and temperature.

87. A semiconductor processing tool comprising:

a semiconductor processing chamber;

an RF generator configured to provide RF power to the semiconductor processing chamber to generate and maintain a plasma;

a photodetector configured to detect an optical signal indicative of a plasma's luminescence in the semiconductor processing chamber, the photodetector configured to convert the optical signal to an analog voltage signal; and

a slope change detection unit configured to:

receive the analog voltage signal,

adjustfilter the analog voltage signal to form an adjusted analog voltage signal,

compare the adjusted analog voltage signal with the analog voltage signal to determine whether changes associated with the adjusted analog voltage signal exceed a threshold, and

in response to the determination, cause a signal to be sent to the RF generator that is configured to cause an adjustment to the RF generator.

98. The semiconductor processing tool of claim 87, further comprising:

a lens on the semiconductor processing chamber configured to allow light within the semiconductor processing chamber to pass through the lens, and

a fiber optic cable between the lens and the photodetector and configured to convey at least a portion of the light that passes through the lens to reach the photodetector.

109. The semiconductor processing tool of claim 87, wherein the slope change detection unit further comprises:

a low-pass filter to filter the analog voltage signal to convert the analog voltage signal to the adjusted analog voltage signal, and

a comparator to compare changes between the adjusted analog voltage signal with and the analog voltage signal.

~~11~~10. The semiconductor processing tool of claim ~~8~~7, wherein the RF generator is configured to reduce the RF power from a first power level to a second power level in response to receiving the signal from the slope change detection unit.

~~12. The semiconductor processing tool of claim 8, wherein the slope change detection unit further comprises:~~

~~a differentiator configured to take a derivative of the voltage signal to convert the voltage signal to the adjusted voltage signal, and~~

~~a comparator configured to determine whether the changes of the adjusted voltage signal exceed the threshold.~~

~~13~~11. The semiconductor processing tool of claim ~~8~~7, further comprising:

a fiber optic cable between the semiconductor processing chamber and the photodetector, ~~are~~wherein the filter optic cable is configured to transmit light generated by the plasma in the semiconductor processing chamber to ~~reach~~ the photodetector.

~~14~~12. The semiconductor processing tool of claim ~~8~~7, wherein:

the photodetector is electrically connected to the RF generator, and wherein

the optical signal from the semiconductor processing chamber is fed from the semiconductor processing chamber to the RF generator.

~~15~~13. The semiconductor processing tool of claim ~~8~~7, wherein:

the photodetector and the slope change detection unit are positioned outside the semiconductor processing chamber or on the semiconductor processing chamber.

~~16~~14. A method of detecting an anomalous plasma event comprising:

forming a plasma utilizing a signal from an RF generator;

detecting a fluctuating optical signal generated by the plasma;

computing a spectral density of the fluctuating optical signal; and

determining that the spectral density of the fluctuating optical signal differs from one or more reference spectral densities of a fluctuating optical signal, generated by the plasma, by a threshold amount.

~~17~~15. The method of claim ~~16~~14, wherein computing the spectral density of the fluctuating optical signal comprises utilizing a Fast Fourier Transform.

~~18~~16. The method of claim ~~16~~14, wherein the one or more reference spectral densities of a fluctuating optical signal correspond to spectral densities of a fluctuating optical signal generated by a plasma maintained under nominal conditions.

~~19~~17. The method of claim ~~18~~16, wherein the threshold amount corresponds to at least one standard deviation relative to the spectral density of the fluctuating optical signal from the plasma maintained under nominal conditions.

~~20~~18. The method of claim ~~16~~14, wherein computing the spectral density of the fluctuating optical signal comprises determining the spectral density of the fluctuating optical signal at a frequency of about 400 kHz or between about 400 kHz and about 4 MHz.