What is claimed is:

1. A method of sensing temperature suitable for use in a semiconductor processing chamber, the method comprising:

passing a first light beam through a first etalon;

passing the first light beam through a substrate disposed in the processing chamber, the substrate providing a second etalon;

generating a reflected second beam and a transmitted second beam from the first light beam after passing the reflected second beam through both of the first etalon and the second etalon;

determining fringe spacing from an interference pattern of one of the reflected second beam or the transmitted second beam; and

determining a temperature of the substrate based on the fringe spacing based on a correlation between the fringe spacing and a temperature of the substrate taking into account a thermo-optic coefficient of the substrate and a thermal expansion coefficient of the substrate.

2. The method of claim 1, wherein the fringe spacing is correlated to an empirically derived thermo-optic coefficient value of one of the first etalon or the second etalon.

3. The method of claim 1, wherein directing the first light beam through the first etalon and the substrate disposed in the processing chamber further comprises directing the first light beam to a surface of the substrate facing away from a lid of the processing chamber and in a direction towards the lid.

4. The method of claim 1, wherein directing the first light beam through the first etalon and the substrate disposed in the processing chamber further comprises directing the first light beam to a surface of the substrate facing a lid of the processing chamber and in a direction away from the lid.

5. The method of claim 1, further comprising:

calibrating a substrate temperature sensor of the processing chamber using the temperature determined using the fringe spacing of the interference pattern.

6. The method of claim 1, wherein directing the first light beam from the first etalon to the substrate further comprises directing the first light beam through a plasma while a plasma process is performed on the substrate disposed within the processing chamber.

7. The method of claim 1, wherein before the determining the fringe spacing, the processing chamber and the substrate are brought to a steady state temperature and a thickness of the substrate is calculated using an initial substrate temperature measurement and a first thickness of the first etalon is adjusted to be within 10 μm of a second thickness of the substrate by moving the first etalon out of a path of the first light beam and placing an alternate first etalon in the path of the first light beam.

8. The method of claim 7, wherein placing the alternate first etalon in the path of the first light beam further comprises:

automatically moving at least one of the first light beam and a first reference etalon of a plurality of reference etalons into alignment based on the thickness of the substrate.

9. The method of claim 1, further comprising:

directing at least the first light beam and a third light beam to different locations of the substrate disposed in the processing chamber.

10. The method of claim 9, wherein directing the first light beam and the third light beam further comprises:

directing the first light beam to a center region of the substrate and directing the third light beam to an edge region of the substrate.

11. The method of claim 9, wherein directing further comprises:

directing at least one light beam to each region of the substrate associated with a temperature control zone of a substrate support supporting the substrate within the processing chamber.

12. The method of claim 1, further comprising one or more of:

calibrating a temperature sensor within the processing chamber using the temperature;

applying a temperature offset to one or more measurements of the temperature sensor;

adjusting a model of a process performed in the processing chamber; and

adjusting a process parameter of the process performed in the processing chamber.

13. A method of sensing temperature suitable for use in a semiconductor processing chamber, the method comprising:

passing a first light beam through a first etalon;

passing the first light beam through a substrate disposed in the processing chamber, the substrate providing a second etalon, wherein the first etalon and the second etalon form an etalon assembly and one of the first etalon or the second etalon generate a reflected second beam and a transmitted second beam from the first light beam;

determining fringe spacing from an interference pattern produced within one of the reflected second beam or the transmitted second beam of the etalon assembly;

determining a temperature of the substrate based on the fringe spacing based on a correlation between the fringe spacing and a temperature of the substrate taking into account a thermo-optic coefficient of the substrate and a thermal expansion coefficient of the substrate; and

providing the temperature to a controller of the processing chamber before performing one or more of:

calibrating a temperature sensor within the processing chamber using the temperature;

applying a temperature offset to one or more measurements of the temperature sensor;

adjusting a model of a process performed in the processing chamber; and

adjusting a process parameter of the process performed in the processing chamber.

14. The method of claim 13, further comprising:

directing at least the first light beam and a third light beam to different locations of the substrate disposed in the processing chamber.

15. The method of claim 13, wherein directing the first light beam from the first etalon to the substrate further comprises directing the first light beam through a plasma while a plasma process is performed on the substrate disposed within the processing chamber.

16. The method of claim 13, wherein before the determining the temperature, the processing chamber and the substrate are brought to a steady state temperature and a thickness of the substrate is calculated using an initial substrate temperature measurement and a first thickness of the first etalon is adjusted to be within 10 μm of a second thickness of the substrate by moving the first etalon out of a path of the first light beam and placing an alternate first etalon in the path of the first light beam.

17. A method of calibrating temperature measurement within a processing chamber, comprising:

performing a process operation on a reference substrate within the processing chamber;

while performing the process operation, measuring a first temperature of a substrate disposed within the processing chamber using a first etalon assembly, the measuring the first temperature of the substrate comprising:

passing a first light beam through a first etalon and a substrate;

intersecting the substrate with the first light beam, wherein the substrate forms a second etalon;

splitting the first light beam into a reflected second beam and a transmitted second beam using one of the first etalon or the second etalon;

collecting one of the reflected second beam or the transmitted second beam using a radiation measurement device; and

determining a fringe spacing from an interference pattern of one of the reflected second beam or the transmitted second beam to determine the first temperature of the substrate from the fringe spacing based on a correlation between the fringe spacing and the first temperature of the substrate taking

into account a thermos-optic coefficient of the substrate and a thermal expansion coefficient of the substrate;

measuring a second temperature of one of the substrate or a substrate support on which the substrate is disposed using a first temperature sensor;

transmitting the first temperature and the second temperature to a controller; and

calibrating a model within the controller using the first temperature and the second temperature.

18. The method of claim 17, wherein the process operation is a plasma etch process.

19. The method of claim 17, wherein a refractive index of the substrate is about 2 to about 6.

20. The method of claim 17, wherein the first temperature and the second temperature are measured along a first annular portion of the substrate and further comprising measuring a third temperature using a second etalon assembly at a second annular portion of the substrate.