CLAIMS

What is claimed is:

1. A method for infrared (IR)-based metrology, comprising:

passing a beam of IR light from an IR light source through a material around a through silicon via (TSV) of a semiconductor device; and

analyzing the beam of IR light after being passed through the material around the TSV to determine information pertaining to stress or defects around the TSV.

2. The method of claim 1, the analyzing comprising measuring a perturbation of a set of optical properties of the material around the TSV along a path of the beam of IR light.

3. The method of claim 2, the measuring comprising applying the following algorithm: $\Delta\phi(x,y) = \int_0^T \Delta n(x,y,z)\frac{2\pi}{\lambda} zdz$.

4. The method of claim 1, further comprising:

emitting a beam of IR light from the IR source; and

splitting the beam into a first portion and a second portion, the passing comprising passing the first portion through the material around the TSV.

5. The method of claim 4, further comprising combining the first portion and the second portion after the first portion has passed through the material around the TSV.

6. The method of claim 5, the analyzing comprising analyzing the beam of IR light after the combining.

7. The method of claim 1, the beam of IR light having a photon energy less than approximately 1.12 eV.

8. A method for infrared (IR)-based metrology, comprising:

emitting a beam of IR light using an IR light source;

passing the beam of IR light through a material around a through silicon via (TSV) of a semiconductor device along a predetermined path; and

analyzing the beam after being passed through the material around the TSV to determine information pertaining to stress or defects around the TSV.

9. The method of claim 8, the analyzing comprising measuring a perturbation of an index of refraction along a path of the beam.

10. The method of claim 9, the measuring comprising applying the following algorithm: $\Delta\phi(x,y) = \int_0^T \Delta n(x,y,z)\frac{2\pi}{\lambda} zdz$.

11. The method of claim 8, further comprising splitting the beam of IR light into a first portion and a second portion, the passing comprising passing the first portion through the material around the TSV.

12. The method of claim 11, further comprising combining the first portion and the second portion after the first portion has passed through the material around the TSV to yield a recombined beam of IR light.

13. The method of claim 12, the analyzing comprising analyzing the recombined beam of IR light.

14. The method of claim 8, the beam of IR light having a photon energy less than approximately 1.12 eV.

15. A method for infrared (IR)-based metrology, comprising:

emitting a beam of IR light using an IR light source;

splitting the beam of IR light into a first portion and a second portion;

passing the first portion of the beam of IR light through a material around a through silicon via (TSV) of a semiconductor device;

combining the first portion with the second portion after the passing; and

analyzing the beam after the combining to determine information pertaining to stress or defects around the TSV.

16. The method of claim 15, the analyzing comprising measuring a perturbation of an index of refraction along a path of the beam.

17. The method of claim 16, the measuring comprising applying the following algorithm: $\Delta\phi(x,y) = \int_0^T \Delta n(x,y,z)\frac{2\pi}{\lambda} zdz$.

18. The method of claim 15, the beam of IR light having a photon energy less than approximately 1.12 eV.

19. The method of claim 15, the analyzing comprising applying an interferometry technique.

20. The method of claim 15, the method being performed in real-time.

What is claimed is:

1. A method for infrared (IR)-based metrology, comprising: emitting a beam of IR light using an IR light source; splitting the beam of IR light into a first portion and a second portion; passing the first portion of the beam of IR light through a material around a through silicon via (TSV) of a semiconductor device; combining the first portion with the second portion after the passing of the first portion through the material around the TSV; and analyzing the beam after the combining to determine information pertaining to stress or defects around the TSV.

2. The method of claim 1, the analyzing comprising measuring a perturbation of an index of refraction along a path of the beam.

3. The method of claim 2, the measuring comprising applying the following algorithm:

$$\Delta\phi(x,y) = \int_0^T \Delta n(x,y,z)\frac{2\pi}{\lambda} z dz$$

wherein T is the total thickness of the semiconductor device, Δn(x,y,z) is the index of refraction perturbation due to stress at a location (x,y,z) in the semiconductor device, λ is the wavelength of the beam, and Δϕ(x,y) is a phase perturbation on a plane (x,y) of the semiconductor device.

4. The method of claim 1, the beam of IR light having a photon energy less than approximately 1.12 eV.

5. The method of claim 1, the analyzing comprising applying an interferometry technique.

6. The method of claim 1, the method being performed in real-time.

7. The method of claim 1, further comprising routing the second portion around the material around the TSV prior to combining said first and second portions.

8. The method of claim 7, wherein routing the second portion around material around the TSV comprises routing the second portion around the semiconductor device.

9. A method for infrared (IR)-based metrology, comprising: emitting a beam of IR light using an IR light source; splitting the beam of IR light into a first portion and a second portion; passing the first portion of the beam of IR light through a material around a through silicon via (TSV) of a semiconductor device; routing the second portion around the material around the TSV; combining the first portion with the second portion after the passing of the first portion through the material around the TSV; and analyzing the beam after the combining to determine information pertaining to stress or defects around the TSV.

10. The method of claim 9, the analyzing comprising measuring a perturbation of an index of refraction along a path of the beam.

11. The method of claim 10, the measuring comprising applying the following algorithm:

$$\Delta\phi(x,y) = \int_0^T \Delta n(x,y,z)\frac{2\pi}{\lambda} z dz$$

wherein T is the total thickness of the semiconductor device, Δn(x,y,z) is the index of refraction perturbation due to stress at a location (x,y,z) in the semiconductor device, λ is the wavelength of the beam, and βϕ(x,y) is a phase perturbation on a plane (x,y) of the semiconductor device.

12. The method of claim 9, the beam of IR light having a photon energy less than approximately 1.12 eV.

13. The method of claim 9, the analyzing comprising applying an interferometry technique.

14. The method of claim 9, the method being performed in real-time.

15. The method of claim 9, wherein routing the second portion around material around the TSV comprises routing the second portion around the semiconductor device.

16. A semiconductor device having a through silicon via (TSV) experiencing defects, the semiconductor device processed by method in accordance with any one of the preceding claims.