CLAIMS

What is claimed is:

1. A system for defect detection and photoluminescence measurement of a sample, comprising:

a radiation source configured to target radiation to the sample;

an optics assembly positioned above the sample to receive a sample radiation, the sample radiation being radiation which is at least one of reflected by, scattered by, or radiated from the sample, the optics assembly configured to collect the sample radiation;

a filter module configured to receive the sample radiation collected by the optics assembly, the filter module separating the sample radiation collected by the optics assembly into a first radiation portion and a second radiation portion;

a defect detection module configured to receive the first radiation portion from the filter module; and

a photoluminescence measurement module configured to receive the second radiation portion from the filter module, the defect detection module and the photoluminescence measurement module configured to receive the respective first radiation portion and the second radiation portion substantially simultaneously.

2. The system of claim 1, wherein the photoluminescence measurement module includes a spectrometer.

3. The system of claim 2, further comprising:

a fiber coupler between the spectrometer and the second radiation portion.

4. The system of claim 2, further comprising:

a photo-detector; and

a bifurcated fiber coupler, the bifurcated coupler located between the second radiation portion and each of the photo-detector and the spectrometer, the bifurcated fiber coupler passing at least a portion of the second radiation portion to each of the photo-detector and the spectrometer.

5. The system of claim 1, wherein the photoluminescence measurement module includes a photo-multiplier tube.

6. The system of claim 1, wherein the filter module includes a first filter and a second filter.

7. The system of claim 6, wherein the first filter is configured to substantially separate the sample radiation a first filtered portion from a second filtered portion, the second filter is configured to receive the second filtered portion from the first filter.

8. The system of claim 7, wherein the second filter is configured to substantially separate a third filtered portion from a fourth filtered portion.

9. The system of claim 8, wherein the defect detection module includes a first light detector and a second light detector, the first light detector is configured to receive the first filtered portion, and the second light detector is configured to receive the third filtered portion.

10. The system of claim 8, wherein the first filtered portion has a first wavelength, the second filtered portion is less than a second wavelength, the third filtered portion is greater than a third wavelength, and the fourth filtered portion is less than a fourth wavelength.

11. The system of claim 10, wherein the first wavelength is approximately 660 nanometers, the second wavelength is approximately 650 nanometers, the third wavelength is approximately 415 nanometers, and the fourth wavelength is approximately 410 nanometers.

12. The system of claim 6, wherein the defect detection module includes a first radiation detector and a second radiation detector, the first radiation detector is configured to receive radiation from the first filter, and the second radiation detector is configured to receive radiation from the second filter.

13. The system of claim 1, wherein the radiation source includes a first radiation source and a second radiation source.

14. The system of claim 13, wherein the first radiation source is configured to generate an oblique input laser beam directed at the sample, and the second radiation source is configured to generate a substantially normal incident laser beam.

15. The system of claim 14, wherein the first radiation portion includes at least one of scattered radiation from the oblique input laser beam or scattered radiation from the substantially normal incident laser beam, and the second radiation portion includes photoluminescence from the sample.

16. The system of claim 1, wherein the detect detection module and the photoluminescence measurement module share an optical head.

17. A method for detecting defects and measuring photoluminescence of a sample, comprising:

irradiating the sample;

collecting radiation from the sample, the collected radiation including radiation which is at least one of reflected by, scattered by, or radiated from the sample;

filtering the collected radiation between a first radiation portion and a second radiation portion;

passing the first radiation portion to a defect detection module;

passing the second radiation portion to a photoluminescence measurement module; and

analyzing the first radiation portion and the second radiation portion substantially simultaneously.

18. The method of claim 17, further including:

measuring a spectral photoluminescence from the second radiation portion.

19. The method of claim 17, further including:

measuring a spectral photoluminescence from the second radiation portion; and

measuring an integrated photoluminescence from the second radiation portion.

20. The method of claim 17, further including:

measuring an integrated photoluminescence from the second radiation portion.

21. A method for detecting defects and measuring photoluminescence of a sample, comprising:

irradiating the sample;

collecting radiation from the sample, the collected radiation including radiation which is at least one of reflected by, scattered by, or radiated from the sample;

filtering the collected radiation between a first radiation portion and a second radiation portion;

passing the first radiation portion to a defect detection module;

passing the second radiation portion to a photoluminescence measurement module;

detecting a scattered defect in at least one of the first radiation portion or the second radiation portion;

identifying a site of interest on the sample according to the scattered defect; and

measuring a spectral photoluminescence of the site of interest.

What is claimed is:

1. A system for defect detection and photoluminescence measurement of a sample, comprising:

a radiation source configured to target radiation to the sample;

an optics assembly positioned above the sample to receive a sample radiation, the sample radiation being radiation which is at least one of reflected by, scattered by, or radiated from the sample, the optics assembly configured to collect the sample radiation;

a filter module configured to receive the sample radiation collected by the optics assembly, the filter module separating the sample radiation collected by the optics assembly into a first radiation portion and a second radiation portion;

a defect detection module configured to receive the first radiation portion from the filter module, the defect detection module configured to detect at least one defect of the sample utilizing the first radiation portion; and

a photoluminescence measurement module configured to receive the second radiation portion from the filter module, the photoluminescence measurement module including a spectrometer configured to detect a local photoluminescence spectrum of the sample utilizing the second radiation portion, the photoluminescence measurement module configured to provide a photoluminescence mapping based upon the detected local photoluminescence spectrum, the defect detection module and the photoluminescence measurement module configured to receive the respective first radiation portion and the second radiation portion substantially simultaneously.

2. The system of claim 1, further comprising:

a fiber coupler between the spectrometer and the second radiation portion.

3. The system of claim 1, further comprising:

a photo-detector; and

a bifurcated fiber coupler, the bifurcated coupler located between the second radiation portion and each of the photo-detector and the spectrometer, the bifurcated fiber coupler passing at least a portion of the second radiation portion to each of the photo-detector and the spectrometer.

4. The system of claim 1, wherein the filter module includes a first filter and a second filter.

5. The system of claim 4, wherein the first filter is configured to substantially separate the sample radiation a first filtered portion from a second filtered portion, the second filter is configured to receive the second filtered portion from the first filter.

6. The system of claim 5, wherein the second filter is configured to substantially separate a third filtered portion from a fourth filtered portion.

7. The system of claim 6, wherein the defect detection module includes a first light detector and a second light detector, the first light detector is configured to receive the first filtered portion, and the second light detector is configured to receive the third filtered portion.

8. The system of claim 6, wherein the first filtered portion has a first wavelength, the second filtered portion is less than a second wavelength, the third filtered portion is greater than a third wavelength, and the fourth filtered portion is less than a fourth wavelength.

9. The system of claim 8, wherein the first wavelength is approximately 660 nanometers, the second wavelength is approximately 650 nanometers, the third wavelength is approximately 415 nanometers, and the fourth wavelength is approximately 410 nanometers.

10. The system of claim 4, wherein the defect detection module includes a first radiation detector and a second radiation detector, the first radiation detector is configured to receive radiation from the first filter, and the second radiation detector is configured to receive radiation from the second filter.

11. The system of claim 1, wherein the radiation source includes a first radiation source and a second radiation source.

12. The system of claim 11, wherein the first radiation source is configured to generate an oblique input laser beam directed at the sample, and the second radiation source is configured to generate a substantially normal incident laser beam.

13. The system of claim 12, wherein the first radiation portion includes at least one of scattered radiation from the oblique input laser beam or scattered radiation from the substantially normal incident laser beam, and the second radiation portion includes photoluminescence from the sample.

14. The system of claim 1, wherein the defect detection module and the photoluminescence measurement module share an optical head.

15. The system of claim 1, wherein the photoluminescence measurement module is further configured to determine an emission spectrum of a light emitting diode fabricated from at least a portion of the sample based upon the photoluminescence mapping.

16. The system of claim 1, wherein at least one of the defect detection module and the photoluminescence measurement module is configured to correlate detected defect information and the photoluminescence mapping, and further configured to determine an adjustment for at least one semiconductor production variable based upon said correlation.

17. A method for detecting defects and measuring photoluminescence of a sample, comprising:

irradiating the sample;

collecting radiation from the sample, the collected radiation including radiation which is at least one of reflected by, scattered by, or radiated from the sample;

filtering the collected radiation between a first radiation portion and a second radiation portion;

passing the first radiation portion to a defect detection module;

passing the second radiation portion to a photoluminescence measurement module;

analyzing the first radiation portion and the second radiation portion substantially simultaneously, including: detecting at least one defect of the sample, via the defect detection module, utilizing the first radiation portion, detecting a local photoluminescence spectrum of the sample, via the photoluminescence measurement module, utilizing the second radiation portion, and providing a photoluminescence mapping based upon the detected local photoluminescence spectrum;

correlating detected defect information and the photoluminescence mapping; and

adjusting at least one semiconductor production variable based upon said correlation.

18. The method of claim 17, wherein detecting the local photoluminescence spectrum from the sample includes:

measuring a spectral photoluminescence from the second radiation portion.

19. The method of claim 17, wherein detecting the local photoluminescence spectrum from the sample includes:

measuring a spectral photoluminescence from the second radiation portion; and

measuring an integrated photoluminescence from the second radiation portion.

20. The method of claim 17, wherein detecting the local photoluminescence spectrum from the sample includes:

measuring an integrated photoluminescence from the second radiation portion.

21. A method for detecting defects and measuring photoluminescence of a sample, comprising:

irradiating the sample;

collecting radiation from the sample, the collected radiation including radiation which is at least one of reflected by, scattered by, or radiated from the sample;

filtering the collected radiation between a first radiation portion and a second radiation portion;

passing the first radiation portion to a defect detection module;

passing the second radiation portion to a photoluminescence measurement module substantially simultaneous to passing the first radiation portion to the defect detection module;

detecting a scattered defect of the sample, via the defect detection module, utilizing the first radiation portion;

identifying a site of interest on the sample according to the scattered defect;

detecting a local photoluminescence spectrum of the sample by at least measuring a spectral photoluminescence of the site of interest, via the photoluminescence measurement module, utilizing the second radiation portion;

providing a photoluminescence mapping based upon the spectral photoluminescence of the site of interest; and

determining an emission spectrum of a light emitting diode fabricated from at least a portion of the sample including the sight of interest based upon the photoluminescence mapping.