CLAIMS

What is claimed is:

1. A method of assessing a quality level of a through silicon via (TSV) formed in a substrate comprising:

obtaining geometric information about a top end of a TSV from an obverse side of the substrate;

obtaining geometric information about a bottom end of a TSV from a reverse side of the substrate;

aligning the geometric information of the top and bottom ends of the TSV to determine an alignment of the respective top and bottom ends of the TSV;

wherein the geometric information comprises at least one of an XY position, a diameter, a centroid, and a shape of the top and bottom ends of the TSV.

2. The method of assessing a quality level of a through silicon via (TSV) of claim 1 further comprising obtaining a thickness value of the substrate substantially at an XY position of the TSV and inferring a geometric volume of the TSV based at least on the geometric information of the respective top and bottom ends of the TSV and determining whether the inferred geometric volume of the TSV is similar to a predetermined criteria.

3. A method of characterizing a microfabrication process and a product formed by the microfabrication process comprising:

determining a location of a plurality of TSV's from an obverse side of a substrate;

determining a location of the same plurality of TSV's from a reverse side of a substrate; and,

determining the presence of a misalignment between the position of a TSV from the obverse and reverse sides of the substrate to identify a process excursion in a microfabrication process.

4. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 further comprising:

determining a geometry of the plurality of TSV's from both the obverse and reverse sides of the substrate; and,

determining whether the geometry of the respective TSV's from the respective obverse and reverse sides of the substrate varies by more than a predetermined criteria selected from a group consisting of size and geometry.

5. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 further comprising:

fitting the location of the plurality of TSV's as determined from the obverse side of the substrate to the location of the plurality of TSV's as determined from the reverse side of the substrate; and,

quantifying the degree of misalignment between the fitted locations of the TSV's, if any.

6. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 wherein determining a location of a plurality of TSV's from an obverse side of a substrate is conducted prior to the filling of the TSV with a conductive material (metallization).

7. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 wherein determining a location of the same plurality of TSV's from a reverse side of a substrate is carried out after the substrate has been thinned from a nominal thickness.

8. A method of characterizing a microfabrication process and a product formed by the microfabrication process comprising:

determining a location of a plurality of TSV's from an obverse side of a substrate;

determining a location of a bottom end of the same plurality of TSV's within a substrate; and,

determining the presence of a misalignment between the position of a TSV from the obverse side of the substrate and the position of the bottom end of the TSV within the substrate to identify a process excursion in a microfabrication process.

9. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 8 further comprising the use of radiation in the near infrared range of wavelengths to obtain a position of the bottom end of the TSV's.

10. An interferometer for characterizing wafers and processes that modify wafers comprising:

a broadband source of light, the output of which is directed along a first optical path toward a substrate that is to be characterized;

a beam splitter positioned along the first optical path which directs at least a portion of light from the first optical path to a second optical path;

an objective for focusing light propagation along the first optical path onto the substrate, the objective collecting and returning light from the substrate along the first optical path to the beam splitter which directs at least a portion of the light returned from the substrate onto a third optical path;

an optical device for reflecting light propagating on the second optical path back to the beam splitter which passes at least a portion thereof onto the third optical path, the optical device having a characteristic chromatic aberration that differs by a predetermined amount for a predetermined range of wavelengths from a characteristic chromatic aberration of the objective; and,

a spectrometer for receiving light propagating along the third optical path and determining from this light an interference pattern that is indicative of a feature of the substrate.

11. The interferometer for characterizing wafers and processes that modify wafers of claim 10 further comprising a removable beam splitter.

12. The interferometer for characterizing wafers and processes that modify wafers of claim 10 further comprising an electrically modifiable beam splitter.

13. The interferometer for characterizing wafers and processes that modify wafers of claim 10 further comprising a filter positioned along the second optical path between the optical device and beam splitter.

14. The interferometer for characterizing wafers and processes that modify wafers of claim 13 wherein the filter comprises a spatial light modulator.

CLAIMS

What is claimed is:

1. A method of assessing a quality level of a through silicon via (TSV) formed in a substrate comprising:

obtaining geometric information about a top end of a TSV from an obverse side of the substrate;

obtaining geometric information about a bottom end of a TSV from a reverse side of the substrate;

aligning the geometric information of the top and bottom ends of the TSV to determine an alignment of the respective top and bottom ends of the TSV.

2. The method of assessing a quality level of a through silicon via (TSV) of claim 1 further comprising obtaining a thickness value of the substrate substantially at an XY position of the TSV and inferring a geometric volume of the TSV based at least on the geometric information of the respective top and bottom ends of the TSV and determining whether the inferred geometric volume of the TSV is similar to a predetermined criteria.

3. A method of characterizing a microfabrication process and a product formed by the microfabrication process comprising:

determining a location of a plurality TSV's from an obverse side of a substrate;

determining a location of the same plurality of TSV's from a reverse side of a substrate; and,

determining the presence of a misalignment between the position of a TSV from the obverse and reverse sides of the substrate to identify a process excursion in a microfabrication process.

4. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 further comprising:

determining a geometry of the plurality of TSV's from both the obverse and reverse sides of the substrate; and,

determining whether the geometry of the respective TSV's from the respective obverse and reverse sides of the substrate varies by more than a predetermined criteria selected from a group consisting of size and geometry.

5. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 further comprising:

fitting the location of the plurality of TSV's as determined from the obverse side of the substrate to the location of the plurality of TSV's as determined from the reverse side of the substrate; and,

quantifying the degree of misalignment between the fitted locations of the TSV's, if any.

6. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 wherein determining a location of a plurality TSV's from an obverse side of a substrate is conducted prior to the filling of the TSV with a conductive material (metallization).

7. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 3 wherein determining a location of the same plurality of TSV's from a reverse side of a substrate is carried out after the substrate has been thinned from a nominal thickness.

8. A method of characterizing a microfabrication process and a product formed by the microfabrication process comprising:

determining a location of a plurality TSV's from an obverse side of a substrate;

determining a location of a bottom end of the same plurality of TSV's within a substrate; and,

determining the presence of a misalignment between the position of a TSV from the obverse side of the substrate and the position of the bottom end of the TSV within the substrate to identify a process excursion in a microfabrication process.

9. The method of characterizing a microfabrication process and a product formed by the microfabrication process of claim 8 further comprising the use of radiation in the near infrared range of wavelengths to obtain a position of the bottom end of the TSV's.

10. An interferometer for characterizing wafers and processes that modify wafers comprising:

a broadband source of light, the output of which is directed along a first optical path toward a substrate that is to be characterized;

a beam splitter positioned along the first optical path which directs at least a portion of light from the first optical path to a second optical path;

an objective for focusing light propagation along the first optical path onto the substrate, the objective collecting and returning light from the substrate along the first optical path to the beam splitter which directs at least a portion of the light returned from the substrate onto a third optical path;

an optical device for reflecting light propagating on the second optical path back to the beam splitter which passes at least a portion thereof onto the third optical path, the optical device having a characteristic chromatic aberration that differs by a predetermined amount for a predetermined range of

wavelengths from a characteristic chromatic aberration of the objective; and,

a spectrometer for receiving light propagating along the third optical path and determining from this light an interference pattern that is indicative of a feature of the substrate.

11. The interferometer for characterizing wafers and processes that modify wafers of claim 10 further comprising a removable beam splitter.

12. The interferometer for characterizing wafers and processes that modify wafers of claim 10 further comprising an electrically modifiable beam splitter.

13. The interferometer for characterizing wafers and processes that modify wafers of claim 10 further comprising a filter positioned along the second optical path between the optical device and beam splitter.

14. The interferometer for characterizing wafers and processes that modify wafers of claim 13 wherein the filter comprises a spatial light modulator.