CLAIMS

What is claimed is:

1. A system for dry eye analysis using terahertz (THz) radiation, the system comprising:

a terahertz radiation measuring system comprising:

a terahertz radiation generator configured to project a THz wave onto a surface of an eye; and

a terahertz radiation detector configured to detect a reflected wave being a reflection of the THz wave reflected from the surface of the eye; and

a signal processing unit configured to communicate with the terahertz radiation detector to analyse properties of the eye in response to the THz wave reflected from the surface of the eye, the properties of the eye comprising thickness of the eye's cornea and ambient tissues and the signal processing unit analyzing the properties of the eye comprises measuring the thickness of the cornea and/or the ambient tissues and/or measuring an amount of chemical components of one or more of the eye's layers.

2. The system of Claim 1 further comprising a smart box interface between the THz wave and the eye, the smart box interface comprising a smart box comprising low refractive index material and/or hydration absorption material for enhancement of sensitivity and/or selectivity of analysis of the properties of the eye.

3. The system in accordance with either Claim 1 or Claim 2 wherein the chemical components of the eye's layers comprise a chemical component selected from collagen, hydration and keratocytes.

4. The system in accordance with any of the preceding claims wherein the signal processing unit analyses the properties of the eye by determining the properties of one or more layers of the eye.

5. The system in accordance with Claim 4 wherein the signal processing unit is configured to calculate a relative corneal composition of the chemical components in the eye's cornea.

6. The system in accordance with Claim 4 wherein the signal processing unit is configured to determine an absolute corneal composition of the chemical components at positions of different cornea layer interfaces using a predefined calibration method, wherein the different cornea layer interfaces comprise an interface between the eye's cornea and a layer selected from an epithelium layer, a stromal layer, and an endothelium layer.

7. The system in accordance with Claim 6 wherein the signal processing unit is configured to calculate a point value that is an absolute corneal hydration for at least one local region of the eye's cornea.

8. The system in accordance with Claim 4 wherein the signal processing unit is configured to calculate an overall average of one or both of the thickness or the chemical components of the eye's cornea in response to the THz wave reflected from the surface of the eye using a predetermined model.

9. The system in accordance with any of the preceding claims wherein the terahertz radiation measuring system further comprises an illumination optical system coupled to the terahertz radiation generator to provide oblique-angle terahertz radiation illumination of the surface of the eye and coupled to the terahertz radiation detector to provide the reflected wave thereto.

10. The system in accordance with Claim 9 wherein the illumination optical system comprises two off-axis parabolic (OAP) mirrors,

wherein a first mirror of the two OAP mirrors is arranged in an optical path of the terahertz radiation generator and is configured to receive the THz wave emitted from the terahertz radiation generator and reflect at least a portion of the THz wave to be project the at least a portion of the THz wave onto the surface of the eye; and

wherein a second mirror of the two OAP mirrors is arranged in a symmetrical position to the first mirror with respect to the eye and is configured to receive at least a portion of the THz wave reflected from the eye.

11. The system in accordance with any of the preceding claims wherein the terahertz radiation detector is configured to detect the reflected wave within a frequency band of 0.1 THz to about 10 THz.

12. The system in accordance with any of the preceding claims wherein the terahertz radiation generator comprises:

a femtosecond laser configured to generate the THz wave; and

a terahertz radiation signal emitter configured to emit the THz wave onto the surface of the eye.

13. A method for dry eye analysis using terahertz (THz) radiation, the method comprising:

projecting a THz wave onto a surface of an eye;

detecting a reflected wave being a reflection of the THz wave reflected from the surface of the eye; and

analysing properties of the eye in response to the THz wave reflected from the surface of the eye, the properties of the eye comprising thickness of the eye's cornea and ambient tissues, wherein analyzing the properties of the eye comprises measuring the thickness of the cornea and/or the ambient tissues and/or measuring an amount of chemical components of one or more of the eye's layers.

14. The method in accordance with Claim 13 wherein the chemical components of the eye's layers comprise a chemical component selected from collagen, hydration and keratocytes.

15. The method in accordance with either Claim 13 or Claim 14 wherein analysing the properties of the eye comprises analyzing the properties of the eye by determining the properties of one or more layers of the eye.

16. The method in accordance with Claim 15 wherein analysing the properties of the eye comprises calculating a relative corneal composition of the chemical components in the eye's cornea.

17. The method in accordance with Claim 15 wherein analysing the properties of the eye comprises determining an absolute corneal composition of the chemical components at positions of different cornea layer interfaces using a predefined calibration method, wherein the different cornea layer interfaces comprise an interface between the eye's cornea and a layer selected from an epithelium layer, a stromal layer, and an endothelium layer.

18. The method in accordance with Claim 17 wherein determining the absolute corneal composition of the chemical components comprises calculating a point value that is an absolute corneal hydration for at least one local region of the eye's cornea.

19. The method in accordance with Claim 15 wherein determining the absolute corneal composition of the chemical components comprises calculating an overall average of one or both of the thickness or the chemical components of the eye's cornea in response to the THz wave reflected from the surface of the eye using a predetermined model.

20. A computer readable medium comprising instructions which, when executed by a system, make the system perform a method for dry eye analysis using terahertz (THz) radiation according to any one of Claims 13 to 20.