CLAIMS

1. A method for determining deterioration of an oil, comprising:

determining a fluorescence rise-time of an oil sample from two or more measurements of induced fluorescence in the oil sample, the oil sample comprising a sample of an oil from a machine;

determining the viscosity of the oil from the fluorescence rise-time;

comparing the viscosity to a viscosity threshold;

determining deterioration of the oil based on the comparison.

2. The method of claim 1, comprising:

emitting light from a light source into the oil sample to induce fluorescence in the oil sample;

measuring, over a time period, the intensity of the detected fluorescence at a sample rate to obtain the two or more measurements.

3. The method of claim 2, wherein the light source comprises a laser.

4. The method of claim 3, wherein the laser emits light comprising a wavelength of 405 nm.

5. The method of claims 2, 3, or 4, wherein the sample rate is 20 milliseconds.

6. The method of claims 2, 3, 4, or 5, wherein measuring, over a time period, the intensity of the detected fluorescence at a sample rate to obtain the two or more measurements comprises measuring the intensity of the detected fluorescence using a photodiode.

7. The method of claims 2, 3, 4, 5, or 6, comprising:

filtering the induced fluorescence before measuring, over a time period, the intensity of the detected fluorescence at a sample rate to obtain the two or more measurements; and

collimating the induced fluorescence before measuring, over a time period, the intensity of the detected fluorescence at a sample rate to obtain the two or more measurements.

8. The method of any one of the preceding claims, wherein determining deterioration of the oil based on the comparison comprising determining that the oil is deteriorated if the viscosity

deviates from the viscosity threshold by a predetermined amount or by a predetermined percentage.

9. The method of any one of the preceding claims, wherein determining the viscosity of the oil from the fluorescence rise-time comprises determining the viscosity according to the following:

$$\text{Viscosity} = \frac{\ln(Risetime) - B}{A} \quad .$$

10. A non-transitory computer-readable storage medium having executable code stored thereon for determining deterioration of an oil, the executable code comprising a set of instructions that causes a viscosity processor to perform the operations comprising:

determining a fluorescence rise-time of an oil sample from two or more measurements of induced fluorescence in the oil sample, the oil sample comprising a sample of an oil from a machine;

determining the viscosity of the oil from the fluorescence rise-time;

comparing the viscosity to a viscosity threshold; and

determining deterioration of the oil based on the comparison.

11. The non-transitory computer-readable medium of claim 10, the operations comprising:

controlling a laser to emit light from a light source into the oil sample to induce fluorescence in the oil sample; and

receiving, over a time period, measurements of the intensity of the detected fluorescence by a detector at a sample rate to obtain the two or more measurements.

12. The non-transitory computer-readable medium of claim 11, wherein the light source comprises a laser.

13. The non-transitory computer-readable medium of claim 12, wherein the laser emits light comprising a wavelength of 405 nm.

14. The non-transitory computer-readable medium of claims 11, 12, or 13, wherein the sample rate is 20 milliseconds.

15. The non-transitory computer-readable medium of claims 11, 12, 13, or 14, wherein the detector comprises a photodiode.

16. The non-transitory computer-readable medium of claims 10, 11, 12, 13, 14, or 15, wherein determining deterioration of the oil based on the comparison comprises determining that the oil is deteriorated if the viscosity deviates from the viscosity threshold by a predetermined amount or by a predetermined percentage.

17. The non-transitory computer-readable medium of claims 10, 11, 12, 13, 14, 15, or 16, wherein determining the viscosity of the oil from the fluorescence rise-time comprises determining the viscosity according to the following:

$$\text{Viscosity} = \frac{\ln(Risetime) - B}{A}$$

18. A portable viscosity determination device, comprising:

a housing;

a light source disposed in the housing and arranged to emit light into an oil sample contained in a sample container, the oil sample comprising a sample of an oil from a machine;

a viscosity processor disposed in the housing;

a non-transitory computer-readable memory disposed in the housing, the memory having executable code stored thereon, the executable code comprising a set of instructions that causes a viscosity processor to perform operations comprising:

determining a fluorescence rise-time of the oil sample from two or more measurements of fluorescence induced by the light source in the oil sample;

determining the viscosity of the oil from the fluorescence rise-time.

19. The portable viscosity determination device of claim 18, the operations comprising:

comparing the viscosity to a viscosity threshold; and

determining deterioration of the oil based on the comparison.

20. The portable viscosity determination device of claim 19, wherein determining deterioration of the oil based on the comparison comprises determining that the oil is deteriorated

if the viscosity deviates from the viscosity threshold by a predetermined amount or by a predetermined percentage.

21. The portable viscosity determination device of claims 18, 19, or 20, comprising a detector arranged to detect the induced fluorescence.

22. The portable viscosity determination device of claim 21, the operations comprising:

controlling the light source to emit light into the oil sample to induce fluorescence in the oil sample; and

receiving, over a time period, measurements of the intensity of the induced fluorescence by the detector at a sample rate to obtain the two or more measurements.

23. The portable viscosity determination device of claim 22, wherein the sample rate is 20 milliseconds.

24. The portable viscosity determination device of claims 21, 22, or 23, wherein the detector comprises a photodiode.

25. The portable viscosity determination device of claims 18, 19, 20, 21, 22, 23, or 24, comprising:

a lens disposed in the housing and arranged to collimate the induced fluorescence before detection of the induced fluorescence by the detector.

26. The portable viscosity determination device of claims 18, 19, 20, 21, 22, 23, 24, or 25, wherein the light source comprises a laser.

27. The portable viscosity determination device of claims 18, 19, 20, 21, 22, 23, 24, 25, or 26, wherein determining the viscosity of the oil from the fluorescence rise-time comprises determining the viscosity according to the following:

$$\text{Viscosity} = \frac{\ln(Risetime) - B}{A} \quad .$$