

1    Claims

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- 3    1.    A microfluidic system for monitoring the condition of lubricating oil comprising:  
4        a microfluidic device comprising at least one microchannel configured to allow a  
5        sample of lubricating oil to pass therethrough as a laminar flow; and a  
6        at least one separating device configured to selectively separate at least one  
7        component from the lubricating oil in the fluid flow; wherein the microfluidic system  
8        comprises a detector device configured to detect the presence and/or measure at  
9        least one property of the at least one component passing through the microfluidic  
10       device after separation in the microchannel.
- 11
- 12    2.    The microfluidic system according to claim 1 wherein the at least one microchannel  
13       comprises a plurality of inlets and outlets wherein a first inlet is configured to receive  
14       an oil sample and/or a second inlet is configured to receive a solvent.
- 15
- 16    3.    The microfluidic system according to claim 1 or 2 wherein the at least one  
17       component from the lubricating oil is selected from the group consisting of metals,  
18       carboxylic acid, n-alkane insolubles and/or sulphur.
- 19
- 20    4.    The microfluidic system according to any preceding claim wherein the detector  
21       device is located in, on, above, below or adjacent to the at least one microchannel.
- 22
- 23    5.    The microfluidic system according to any preceding claim comprising at least one  
24       observation site.
- 25
- 26    6.    The microfluidic system according to any preceding claim comprising a light source.
- 27
- 28    7.    The microfluidic system according to any preceding claim wherein the detector  
29       device comprises at least one sensor selected from the group comprising a  
30       spectrometer, camera, CCD device, conductivity sensor, capacitance sensor and/or  
31       a metal responsive to a chemical analyte.
- 32
- 33    8.    The microfluidic system according to claim 7 wherein the at least one sensor may be  
34       a spectrometer to detect, measure and/or record a spectrum from the at least one  
35       component of the lubricating oil.
- 36

- 1 9. The microfluidic system according to any preceding claim wherein the at least one  
2 component is detected or measured by measuring UV-absorption and/or measuring  
3 a difference in UV-Vis Absorption.  
4
- 5 10. The microfluidic system according to any preceding claim wherein the at least one  
6 separation device is selected from the group comprising a diffusion extractor, a  
7 magnet and/or a metal-based sulphur removal device.  
8
- 9 11. The microfluidic system according to claim 10 wherein the at least one separation  
10 device is a diffusion extractor.  
11
- 12 12. The microfluidic system according to claim 11 wherein the diffusion extractor  
13 comprises a diffusion channel and the first inlet and/or second inlet are in fluid  
14 communication with the diffusion channel.  
15
- 16 13. The microfluidic system according to any of claims 11 or 12 wherein the diffusion  
17 extractor is a H-filter.  
18
- 19 14. The microfluidic system according to claim 10 wherein the at least one separation  
20 device is a magnet and the detector device is an electrical conductivity sensor and/or  
21 an electrical capacitance sensor.  
22
- 23 15. The microfluidic system according to claim 10 wherein the separation device is a  
24 metal-based sulphur removal device selected from the group comprising copper or  
25 silver and the detector device comprises a camera and/or a CCD device.  
26
- 27 16. The microfluidic system according to any preceding claim wherein the detector  
28 device is configured to measure a first component of the oil sample which may be  
29 used to infer or determine the presence or measurement level of a second  
30 component of the oil sample.  
31
- 32 17. The microfluidic system according to any preceding claim comprising more than one  
33 separating device selected from the group comprising a diffusion extractor, a magnet  
34 and/or a metal-based sulphur removal device.  
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- 36 18. A method of monitoring the condition of lubricating oil comprising

- 1 providing a microfluidic system comprising:  
2 a microfluidic device comprising at least one microchannel; and  
3 at least one separating device; and  
4 a detector device;  
5 passing a sample of the lubricating oil through the at least one microchannel in a  
6 laminar flow; and  
7 separating at least one component from the lubricating oil in the flow; and  
8 detecting detect the presence and/or measure at least one property of the at least  
9 one component passing through the microfluidic device after separation in the  
10 microchannel.  
11
- 12 19. The method according to claim 18 comprising detecting the presence and/or  
13 measuring at least one modal properties of the at least one component in the  
14 sample.  
15
- 16 20. The method according to claim 19 comprising detecting the presence of and/or  
17 measuring the at least one component by spectrometry, electrical conductivity,  
18 electrical capacitance and/or reactivity of the at least one component to a chemical  
19 indicator.  
20
- 21 21. The method according to claims 19 or 20 comprising separating the at least one  
22 component from the lubricating oil sample by mass transfer, diffusion, magnetic  
23 attraction and/or chemical interaction.  
24
- 25 22. The method according to any of claims 19 to 21 comprising taking at least one  
26 measurement of the lubricating oil sample before separating the at least one  
27 component and comparing with at least one measurement of the sample taken after  
28 the at least one component is separated.  
29
- 30 23. The method according to any of claims 19 to 22 comprising comparing a spectrum of  
31 the lubricating oil sample before separating the at least one component with a  
32 spectrum of the extracted at least one component.  
33
- 34 24. The method according to any of claims 19 to 23 comprising detecting, measuring  
35 and/or recording an electrical capacitance and/or electrical conductivity of the

1 sample after the at least one component is separated or partially separated from the  
2 flow.

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4 25. The method according to any of claims 19 to 24 comprising detecting, measuring  
5 and/or recording a chemical response of the at least one component to metal sensor  
6 and/or metal reagent.

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