

Claims

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1. A microfluidic chip comprising:
at least one microfluidic reservoir having a wall portion and a heat
transfer sealing layer cooperating with the wall portion for receiving a
sample to be tested, the heat transfer sealing layer being arranged to be
contiguous with the sample to be tested; and
an active temperature control device arranged to provide structural
support to the heat transfer sealing layer and operable to control a
temperature of the sample via transmission of heat through the heat
transfer sealing layer.

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2. A microfluidic chip according to claim 1, wherein the transmission of heat
through the heat transfer sealing layer includes transmission of heat from
the sample to the active temperature control device.

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3. A microfluidic chip according to claim 1 or 2, wherein the heat transfer
sealing layer includes an adhesive layer.

4. A microfluidic chip according to any one of the preceding claims, wherein
the heat transfer sealing layer is integral with the active temperature
control device.

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5. A microfluidic chip according to any one of the preceding claims, wherein
the active temperature control device is a thermoelectric heat pump or a
fluidic heat exchanger.

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6. A microfluidic chip according to any one of the preceding claims, wherein
the heat transfer sealing layer comprises a metallic film.

7. A microfluidic chip according to any one of the preceding claims, wherein the wall portion defines a first microfluidic reservoir profile and wherein the first microfluidic reservoir profile comprises a first periodically oscillating section.
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8. A microfluidic chip according to claim 7, wherein the first microfluidic reservoir profile further comprises two or more substantially linear sections and a junction fluidically connecting the two or more substantially linear sections to the first periodically oscillating section.
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9. A microfluidic chip according to any one of claims 1 to 6, wherein the wall portion defines a second microfluidic reservoir profile and wherein the second microfluidic reservoir profile comprises: a first periodically oscillating section; a second periodically oscillating section; a third section arranged between the first and second periodically oscillating sections, the third section having a non-oscillating configuration and comprising a first chamber region; first and second tapering portions which fluidically connect the first and second periodically oscillating sections, respectively, to the first chamber region; and a width, the width
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- being greater at the first chamber region than in the first and second oscillating sections.
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10. A microfluidic chip according to claim 9, wherein each of the first and second tapering portions is curved.
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11. A microfluidic chip according to claim 9, wherein each of the first and second tapering portions is substantially straight.
12. A microfluidic chip according to claim 9, wherein the third section further comprises a second chamber region, and wherein the microfluidic reservoir profile further comprises third and fourth tapering portions which fluidically connect the first and second periodically oscillating

sections to the second chamber region, respectively, wherein the width is greater at the second chamber region than in the first and second periodically oscillating sections.

- 5 13. A microfluidic chip according to any one of claims 1 to 6, wherein the wall portion defines a third microfluidic reservoir profile comprising a first periodically oscillating section arranged to oscillate in a first direction; a second periodically oscillating section arranged to oscillate in the first direction; and a third periodically oscillating section positioned between
10 and fluidically connected to the first and second periodically oscillating sections and arranged to oscillate in a second direction which is perpendicular to the first direction.
- 15 14. A microfluidic chip according to any one of claims 1 to 6, wherein the wall portion defines a fourth microfluidic reservoir profile and wherein the microfluidic chip further comprises an elastomeric seal arranged to surround the fourth microfluidic reservoir profile and wherein the heat transfer sealing layer cooperates with the wall portion via the elastomeric
20 seal.
15. A microfluidic chip according to any one of the preceding claims, wherein the at least one microfluidic reservoir further comprises at least one of a first inlet and a first outlet wherein the at least one of the first inlet and the
25 first outlet are operable to receive a plug.
16. A microfluidic chip according to claim 15, wherein the at least one microfluidic reservoir further comprises the plug received in the least one of the first inlet and the first outlet.
- 30 17. A microfluidic chip according to any one of the preceding claims, wherein the at least one microfluidic reservoir comprises at least one of a second

inlet and a second outlet, the microfluidic chip further comprising an adhesive sealing layer arranged to seal the at least one of the second inlet and the second outlet.

- 5 18. A microfluidic chip according to any one of claims 1 to 6 further including a reservoir plate comprising: the wall portion and an edge surface, and wherein the at least one microfluidic reservoir comprises a third inlet comprising an aperture in the edge surface of the reservoir plate.

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19. A microfluidic chip according to any one of the preceding claims, comprising:
a plurality of the microfluidic reservoirs, each microfluidic reservoir having a respective wall portion, wherein the heat transfer sealing layer
15 cooperates with each of the respective wall portions for receiving a respective sample to be tested, the heat transfer sealing layer being arranged to be contiguous with each respective sample to be tested, the active temperature control device operable to control a temperature of each of the respective samples via transmission of heat through the heat
20 transfer sealing layer.

20. A microfluidic chip according to claim 19, wherein each respective wall portion comprises a through hole.

- 25 21. A microfluidic chip according to claim 19, wherein each respective wall portion defines a respective microfluidic reservoir profile, and wherein at least two of the respective reservoir profiles differ in at least one of shape and sample capacity.

- 30 22. A microfluidic chip comprising:
at least one microfluidic reservoir having a wall portion and a heat transfer sealing layer cooperating with the wall portion for receiving a

sample to be tested, the heat transfer sealing layer being arranged to be contiguous with the sample to be tested; and
a fluidic heat exchanger operable to control a temperature of the sample via transmission of heat through the heat transfer sealing layer.

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23. A microfluidic chip according to claim 22, wherein the heat transfer sealing layer includes a metal plate.

24. A microfluidic system comprising

10 a microfluidic chip according to any one of the preceding claims; and a further at least one microfluidic reservoir comprising a further wall portion, and a further heat transfer sealing layer cooperating with the further wall portion for receiving a further sample to be tested, the further heat transfer sealing layer being arranged to be contiguous with the
15 further sample to be tested, the further at least one microfluidic reservoir operable to replace the at least one microfluidic reservoir, the active temperature control device being further operable, upon replacement of the at least one microfluidic reservoir with the further at least one microfluidic reservoir, to provide structural support to the further heat
20 transfer sealing layer and to control a temperature of the further sample via transmission of heat through the further heat transfer sealing layer.

25. A microfluidic platform comprising a plurality of fluidically connected microfluidic chips, the plurality of microfluidic chips including one or more
25 microfluidic chips according to any one of the claims 1 to 23.

26. A detection module for detecting optical signals from a plurality of samples, the detection module comprising:
an ambient light shielding cassette; and
30 a slot configured to receive the plurality of samples;
the ambient light shielding cassette comprising:

a first light source operable to illuminate the plurality of samples to produce respective optical signals; and
a first camera operable to receive the respective optical signals simultaneously and directly from each of the plurality of samples.

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27. A detection module according to claim 26, wherein each of the plurality of samples is received in a microfluidic reservoir of a microfluidic chip comprising a plurality of microfluidic reservoirs.

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28. A detection module according to claim 27, wherein each of the plurality of samples is received in the microfluidic reservoir of a microfluidic chip according to any of claims 19 to 21.

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29. A detection module according to any one of claims 26 to 28, further comprising one or more filters and/or polarisers in an optical path between the plurality of samples and the first camera.

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30. A detection module according to claim 29, further comprising a first filter in the optical path; and a second filter, the first filter being operable to be removed from the optical path and replaced with the second filter.

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31. A detection module according to claim 30, further comprising a disk in which the first and second filters are mounted, and wherein the first filter is operable to be removed from the optical path and replaced with the second filter by the rotation of the disk.

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32. A detection module according to claim 30, further comprising; a first cartridge in which the first filter is mounted, the first cartridge being mounted within the ambient light shielding cassette; and a second cartridge in which the second filter is mounted, and wherein the first filter is operable to be removed from the optical path and replaced with the second filter by means of removal of the first cartridge from the ambient

light shielding cassette and replacement of the first cartridge within the ambient light shielding cassette by the second cartridge.

5 33. A detection module according to any one of claims 26 to 32, further comprising a second camera operable to receive the respective optical signals simultaneously and directly from each of the samples.

10 34. A detection module according to any one of claims 26 to 33, further comprising a second light source, wherein the first light source and the second light source are operable to produce light with different wavelengths.

15 35. A detection module according to any one of claims 26 to 34, wherein the first light source is a multi-channel light source.

20 36. A detection module according to any one of claims 26 to 35, wherein the first camera is arranged to receive optical signals from four or more of the plurality of samples simultaneously.

25 37. A detection module according to any one of claims 26 to 36, wherein a field of view of the first camera is at least 40x40mm².

30 38. A detection module according to any one of claims 26 to 37, further comprising a microfluidic chip received within the slot.

35 39. A method of detecting a signal from a plurality of samples, the samples being received in a plurality of microfluidic reservoirs of a microfluidic chip, the method comprising:

40 illuminating the plurality of samples using a light source to produce respective optical signals; and

simultaneously and directly receiving each of the respective optical signals at a camera.

5 40. A method of detecting a signal from a plurality of samples according to claim 39, the samples being received in the plurality of the microfluidic reservoirs of a microfluidic chip according to any of claims 19 to 21.

10 41. A method of detecting a signal from a plurality of samples according to claim 39 or 40, wherein simultaneously and directly receiving each of the respective optical signals at the camera comprises capturing all of the respective optical signals as a single image and wherein the method further comprises: processing the respective optical signals using a processor by dividing the single image into a plurality of cropped images, such that each of the cropped images corresponds to a single sample of
15 the plurality of samples.

42. A microfluidic platform comprising:
a microfluidic chip comprising a plurality of microfluidic reservoirs;
a detection module according to any one of claims 26 to 38; and
20 a system comprising:
an input for receiving an image from the detection module;
a processor configured to divide the image into a plurality of cropped images, such that each of the plurality of cropped images corresponds to a single sample of the plurality of samples; and an output configured to
25 output the plurality of cropped images.

43. A microfluidic platform according to claim 42, wherein the microfluidic chip comprises a microfluidic chip according to any one of claims 19 to
30 21.

44. A system for performing one or more microfluidic temperature-controlled processes concurrently, the system comprising a plurality of microfluidic chips according to any one of claims 1 to 23.
- 5 45. A system for performing one or more microfluidic temperature-controlled processes concurrently according to claim 44, the system further comprising a plurality of detection modules according to any one of claims 26 to 37, each detection module of the plurality of detector modules operable to detect optical signals from a different one of the
- 10 plurality of microfluidic chips.