CLAIMS

1. A microfluidic device for gel electrophoresis, comprising:
a sample channel configured to receive a sample;
a stacking channel comprising a preloaded stacking reagent; and
a separation channel comprising a preloaded separation reagent;
a plurality of layers; and
a buffer channel comprising a running buffer reagent, wherein the buffer channel is in fluid communication with the sample channel;
wherein the preloaded stacking reagent has a physical characteristic different from that of the preloaded separation reagent;
wherein the stacking channel and the separation channel are arranged on different layers of the plurality of layers; and
wherein the sample channel, the stacking channel and the separation channel are in fluid communication with one another.

2. The microfluidic device of claim 1, wherein the preloaded stacking reagent has the physical characteristic of at least one of a pH level or an average pore size different from that of the preloaded separation reagent.

3. The microfluidic device of claim 1, wherein each of the stacking channel and the separation channel is a closed channel that is prevented from exposure to air.

4. The microfluidic device of claim 1, wherein the stacking channel and the separation channel are fluidly connected to each other by a through-hole.

5. The microfluidic device of claim 4, wherein the through-hole comprises a rectangle-shaped through-hole arranged lengthwise across a width of the separation channel.

6. The microfluidic device of claim 1, wherein the stacking channel and the separation channel are arranged downstream with respect to the sample channel.

7. The microfluidic device of claim 1, further comprising a first pair of reservoirs in fluid communication with the stacking channel; and a second pair of reservoirs in fluid communication with the separation channel,
wherein the first pair of reservoirs is configured to provide a first inlet and a first outlet for a liquid stacking reagent to be loaded in the stacking channel to form the preloaded stacking reagent; and

wherein the second pair of reservoirs is configured to provide a second inlet and a second outlet for a liquid separation reagent to be loaded in the separation channel to form the preloaded separation reagent.

8. The microfluidic device of claim 1, further comprising a plurality of layers, wherein the buffer channel and the sample channel are arranged on different layers of the plurality of layers.

9. The microfluidic device of claim 8, wherein the sample channel is arranged on a first layer of the plurality of layers, and the buffer channel is arranged on a second layer of the plurality of layers; and wherein the first layer is arranged over the second layer.

10. The microfluidic device of claim 8, wherein the buffer channel and the sample channel are fluidly connected to each other by a through-hole.

11. The microfluidic device of claim 1, wherein the sample channel is arranged between the buffer channel and the stacking channel.

12. The microfluidic device of claim 1, wherein the running buffer reagent comprises a preloaded running buffer gel.

13. The microfluidic device of claim 12, further comprising a third pair of reservoirs in fluid communication with the buffer channel,

wherein the third pair of reservoirs is configured to provide a third inlet and a third outlet for a liquid running buffer reagent to be loaded in the buffer channel to form the preloaded running buffer gel.

14. The microfluidic device of claim 1, further comprising at least two electrical contact points for coupling to an electrical source to provide an electrical field across the at least two electrical contact points, wherein the buffer channel, the sample channel, the stacking channel and the separation channel are arranged between the at least two electrical contact points.

15. The microfluidic device of claim 1, further comprising a plurality of main channels, each of the plurality of main channels comprising a buffer channel, a sample channel, a stacking channel and a separation channel in fluid communication with one another.

16. The microfluidic device of claim 15, further comprising at least two electrical contact points for coupling to an electrical source to provide an electrical field across the at least two

electrical contact points, wherein the plurality of main channels are arranged between the at least two electrical contact points.

17. A method of manufacturing a microfluidic device for gel electrophoresis, the method comprising:

providing a microfluidic device comprising:

a sample channel configured to receive a sample;

a stacking channel;

a separation channel;

a plurality of layers; and

a buffer channel, wherein the buffer channel is in fluid communication with the sample channel;

wherein the sample channel, the stacking channel and the separation channel are in fluid communication with one another; and

wherein the stacking channel and the separation channel are arranged on different layers of the plurality of layers;

loading the stacking channel with a liquid stacking reagent to form a preloaded stacking reagent;

loading the separation channel with a liquid separation reagent to form a preloaded separation reagent; and

loading the buffer channel with a running buffer reagent to form a preloaded buffer reagent;

wherein the preloaded buffer reagent has a physical characteristic different from that of the preloaded stacking reagent and the preloaded separation reagent; and

wherein the preloaded stacking reagent has a physical characteristic different from that of the preloaded separation reagent.