Claims

1. Biological sensing apparatus configured to sense particles comprised in fluent material, the biological sensing apparatus comprising:

a flow arrangement comprising a channel configured to contain and provide for flow of fluent material;

stimulation apparatus which is configured to, in use, stimulate particles comprised in the fluent material by application of at least one of an electrostatic field and an electrodynamic field to the fluent material flowing through the channel, the stimulation apparatus comprising at least one pair of electrodes, which are disposed side by side on a same side of the fluent material flowing in the channel, and an electric field source, the stimulation apparatus being comprised in a planar integrated circuit formed by a semiconductor fabrication process; and

particle sensing apparatus comprised in the integrated circuit formed by the planar semiconductor fabrication process, the particle sensing apparatus being configured to sense an electric field, the particle sensing apparatus comprising at least one pair of electrodes, the pair of electrodes being disposed side by side relative to the flow arrangement and on the same side of the fluent material flowing in the channel as the at least one pair of electrodes of the stimulation apparatus such that the particle sensing apparatus is operative to sense an electric field of particles comprised in the fluent material as the fluent material flows through the channel,

wherein the stimulation apparatus applies a predetermined stimulation signal to the fluent material and the biological sensing apparatus compares the predetermined stimulation signal with a response to the predetermined stimulation signal sensed by the particle sensing apparatus.

2. Biological sensing apparatus according to claim 1 in which an electrode of a pair of electrodes has a dimension of less than one of 100 microns, 50 microns, 30 microns, 20 microns, 15 microns, 10 microns, 5 microns, 3 microns and 1 micron.

3. Biological sensing apparatus according to claim 1 or 2 in which the particle sensing apparatus comprises plural spaced apart sensing arrangements, each

sensing arrangement being operative to sense particles, the flow arrangement defining a flow path along which a particle travels and the particle sensing apparatus being configured such that as a particle travels along the flow path the particle is sensed by successive sensing arrangements.

4. Biological sensing apparatus according to any one of claims 1 to 3 in which the particle sensing apparatus comprises an array of electrodes, the array of electrodes extending in a direction of flow of fluent material through the flow arrangement and extending in a direction orthogonal to the direction of flow of fluent material.

5. Biological sensing apparatus according to any one of claims 1 to 4 in which the particle sensing apparatus further comprises a sensing circuit configured to receive an input signal from the at least one pair of electrodes to provide a corresponding output signal, the sensing circuit being configured to sense charge.

6. Biological sensing apparatus according to claim 5 in which the sensing circuit comprises a capacitance which is operative to sense charge and is operative to convert the sensed charge to at least one of a voltage signal and a current signal.

7. Biological sensing apparatus according to any one of the preceding claims in which the particle sensing apparatus is configured to sense at least one of an electrostatic field and an electrodynamic field.

8. Biological sensing apparatus according to any one of the preceding claims configured such that the stimulation apparatus and the particle sensing apparatus are operative simultaneously.

9. Biological sensing apparatus according to claim 8 in which electrodes of the particle sensing apparatus and the stimulation arrangement are substantially electrically isolated from fluent material in the flow arrangement.

10. Biological sensing apparatus according to any one of the preceding claims in which the particle sensing apparatus is configured for at least one of single ended sensing and differential sensing.

11. Biological sensing apparatus according to any one of the preceding claims comprising an array of actuating elements which extend in a direction perpendicular to a direction of flow of fluent material through the flow arrangement, the array of actuating elements being disposed relative to the flow arrangement so as to impart a force on a particle in the flow arrangement, the array of actuating elements being operative in dependence on an output from the particle sensing apparatus.

12. Biological sensing apparatus according to any one of the preceding claims configured to sense microbiological samples.

13. Biological sensing apparatus according to any one of the preceding claims in which the semiconductor fabrication process is a metal-oxide semiconductor process.

14. Biological analysis apparatus comprising biological sensing apparatus according to any one of the preceding claims.

15. A biological sensing method for sensing particles comprised in fluent material, the method comprising:

containing fluent material in a channel of a flow arrangement and providing for flow of the fluent material therethrough;

applying a predetermined stimulation signal by a stimulation apparatus to stimulate particles comprised in the fluent material, by application of at least one of an electrostatic field and an electrodynamic field to the fluent material flowing through the channel, the stimulation apparatus comprising at least one pair of electrodes, which are disposed side by side on a same side of the fluent material flowing in the channel, and an electric field source, the stimulation apparatus being comprised in a planar integrated circuit formed by a semiconductor fabrication process; sensing an electric field of particles comprised in the fluent material as

the fluent material flows through the channel, the electric field of the particles being sensed by particle sensing apparatus disposed relative to the flow arrangement, the particle sensing apparatus being comprised in the planar integrated circuit formed by the semiconductor fabrication process, the particle sensing apparatus comprising at least one pair of electrodes, the pair of electrodes being disposed side by side relative to the flow arrangement and on the same side of the fluent material flowing in the channel as the at least one pair of electrodes of the stimulation apparatus; and

comparing a predetermined stimulation signal with a response to the predetermined stimulation signal sensed by the particle sensing apparatus, the stimulation apparatus applying the predetermined stimulation signal to the fluent material.