Claims

1. Apparatus for dispensing particles in free-flying liquid drops, comprising:

a fluid chamber fluidically coupled to a nozzle;

a sound source configured to generate, in the fluid chamber, an acoustic field by which particles in a liquid in the fluid chamber may be aligned in an arrangement; and

a drop-on-demand mechanism configured to, at a selected point in time, selectively dispense from the nozzle an individual liquid drop containing one or several particles,

wherein the drop-on-demand mechanism is configured to move the particles towards the nozzle in a step-by-step manner,

wherein the sound source is configured to switch between a mode in which the acoustic field is generated with a first frequency so that the particles are aligned along at least one line in parallel to the movement direction, and a second mode in which the acoustic field is generated with a second frequency so that the particles are aligned along at least one line perpendicular to the movement direction and held in the fluid chamber.

2. Apparatus according to claim 1, wherein the sound source comprises an adjustable frequency.

3. Apparatus according to claim 1 or 2, wherein chamber walls of the fluid chamber which are transversely opposite to the movement direction comprise a distance to each other corresponding to an integer multiple of half the wavelength of the first frequency.

4. Apparatus according to any one of the claims 1 to 3, wherein the line is aligned centrally in the fluid chamber towards the nozzle in parallel to the movement direction.

5. Apparatus according to any one of the claims 1 to 4, wherein the fluid chamber comprises chamber walls opposite in the movement direction in which the nozzle and an inlet opening are formed, wherein the chamber walls opposite in the movement direction comprise a distance to each other corresponding to an integer multiple of half the wavelength of the second frequency.

6. Apparatus according to claim 2, further comprising a controller configured to control the sound source in order to generate the acoustic field either with the first frequency or the second frequency.

7. Apparatus according to any one of the claims 1 to 6, further comprising a sensor configured to sense information with regard to if a particle is arranged in a volume of interest dispensed from the nozzle with one of the next drops, wherein the sound source is configured to generate an acoustic field by which one of the particles is arranged in the volume of interest.

8. Apparatus according to claim 7, configured to dispense a dispensed drop to a first position or a second position depending on the sensed information.

9. Method for dispensing particles in free-flying liquid drops, comprising:

generating an acoustic field in a fluid chamber fluidically coupled to a nozzle in order to align particles in a liquid in the fluid chamber in an arrangement; and

applying a drop-on-demand mechanism configured to, at a selected point in time, selectively dispense an individual drop from the nozzle in order to eject from the nozzle a free-flying liquid drop containing one or several particles, wherein, by applying the drop-on-demand mechanism, the particles are moved towards the nozzle in a step-by-step manner,

switching between a mode in which the acoustic field is generated with a first frequency so that the particles are aligned along at least one line in parallel to the movement direction, and a mode in which the acoustic field is

generated with a second frequency so that the particles are aligned along at least one line perpendicular to the movement direction and held in the fluid chamber.

10. Method according to claim 9, wherein the particles are aligned and held along the line perpendicular to the movement direction while, by applying the drop-on-demand mechanism, a drop containing no particle is ejected from the nozzle.

11. Method according to claim 9 or 10, further comprising sensing information with regard to if a particle is arranged in a volume of interest dispensed from the nozzle with one of the next drops, wherein one of the particles is arranged in the volume of interest by the acoustic field, and comprising dispensing a drop to a first position or a second position depending on the sensed information.