Claims

1. A flow reactor system comprising:

a plurality of liquid pumps for communicating a plurality of liquid reagents based on a set of flow conditions;

a fluid pump for communicating a carrier fluid that is immiscible with the liquid reagents;

a fluidic mixer for mixing the liquid reagents into a liquid mixture, the fluidic mixer comprising:

a plurality of liquid inlets for receiving the liquid reagents from the liquid pumps;

a fluid inlet for receiving the carrier fluid from the fluid pump; and

an outlet for discharging the liquid mixture and the carrier fluid, wherein the liquid mixture is discharged from the outlet as a series of liquid plugs separated by the carrier fluid;

a fluidic tubing connected to the outlet, such that the liquid plugs are discharged from the outlet into the fluidic tubing and dispensable from the fluidic tubing;

a measurement device coupled to the fluidic tubing for measuring properties of the liquid plugs flowing through the fluidic tubing before dispensing therefrom, the properties comprising flow rate of the liquid plugs;

the measurement device comprising a first photodetector and a second photodetector disposed at a fixed distance from each other, the photodetectors configured for measuring the flow rate of the liquid plugs flowing through the fluid tubing before dispensing therefrom; and

a control module configured for controlling the liquid pumps and adjusting the flow conditions based on the measured properties of the liquid plugs, wherein the liquid plugs are representative of different flow conditions,

wherein the measured properties comprise the flow rate of the liquid plugs that is variable based on the different flow conditions to thereby facilitate dispensation of the liquid plugs from the fluidic tubing.

2. The system according to claim 1, wherein the flow conditions comprise volume and flow rate of the liquid reagents.

3. The system according to claim 1 or 2, further comprising a mass flow controller for controlling the fluid pump.

4. The system according to claim 3, wherein the mass flow controller is configured to control the fluid pump to communicate the carrier fluid at up to 5 sccm.

5. The system according to claim 3 or 4, wherein the mass flow controller is configured to automatically compensate for fluid pressure changes.

6. The system according to any one of claims 1 to 5, wherein the properties further comprise volume and intensity of the liquid plugs that are measurable by the photodetectors.

7. The system according to any one of claims 1 to 6, wherein the photodetectors comprise infrared photointerrupters.

8. The system according to any one of claims 1 to 7, wherein the control module is configured to iteratively adjust the flow conditions to optimize one or more pre-selected properties of the liquid plugs.

9. The system according to any one of claims 1 to 8, wherein the control module is configured for training a machine learning model using training data derived from the measured properties.

10. The system according to claim 9, wherein the machine learning model is trained to iteratively generate new sets of flow conditions.

11. The system according to any one of claims 1 to 10, wherein a liquid plug is dispensable from the fluidic tubing by drop casting as a thin film on a substrate.

12. The system according to claim 11, further comprising a tube holder coupled to the fluidic tubing for facilitating dispensation of the liquid plugs.

13. The system according to claim 12, further comprising an actuation assembly for dispensing the liquid plugs over an area.

14. The system according to claim 13, wherein the tube holder is coupled to the actuation assembly such that the tube holder is moveable horizontally.

15. The system according to claim 13 or 14, wherein the tube holder and actuation assembly are integrated in a 3D printing machine.

16. A flow reaction method comprising:

communicating a plurality of liquid reagents from a plurality of liquid pumps to a plurality of liquid inlets of a fluidic mixer based on a set of flow conditions;

communicating a carrier fluid from a fluidic pump to a fluid inlet of the fluidic mixer, the carrier fluid being immiscible with the liquid reagents;

mixing the liquid reagents into a liquid mixture in the fluidic mixer;

discharging the liquid mixture and the carrier fluid from an outlet of the fluidic mixer, the liquid mixture being discharged as a series of liquid plugs separated by the carrier fluid;

communicating the liquid plugs from the outlet into a fluidic tubing connected to the outlet;

dispensing the liquid plugs from the fluidic tubing;

measuring, using a measurement device coupled to the fluidic tubing, properties of the liquid plugs flowing through the fluidic tubing before dispensing therefrom, the properties comprising flow rate of the liquid plugs;

measuring, using a first photodetector and a second photodetector of the measurement device and disposed at a fixed distance from each other, the flow rate of the liquid plugs flowing through the fluid tubing before dispensing therefrom;

controlling the liquid pumps and adjusting the flow conditions based on the measured properties of the liquid plugs, the measured properties comprising the flow rate of the liquid plugs, wherein the liquid plugs are representative of different flow conditions; and

varying the flow rate of the liquid plugs based on the different flow conditions to thereby facilitate dispensation of the liquid plugs from the fluidic tubing.

17. The method according to claim 16, further comprising iteratively adjusting the flow conditions to optimize one or more pre-selected properties of the liquid plugs.

18. The method according to claim 16 or 17, further comprising:

training a machine learning model using training data derived from the measured properties; and

iteratively generating new sets of flow conditions using the trained machine learning model.

19. The method according to any one of claims 16 to 18, further comprising drop casting a liquid plug from the fluidic tubing as a thin film on a substrate.

20. The method according to claim 19, further comprising moving a tube holder coupled to the fluidic tubing, horizontally to facilitate drop casting of the liquid plugs as an array of thin films on one or more substrates.