CLAIMS

1. A system for creating pharmaceutical products by additive manufacturing, comprising:

a material supply module for receiving a set of printing materials for creating the pharmaceutical products;

a flow distribution module comprising a flow distribution plate,

wherein the material supply module is configured to transport a single flow corresponding to the set of printing materials to the flow distribution plate;

wherein the flow distribution plate comprises: a plurality of channels for dividing the single flow into a plurality of flows;

a plurality of nozzles; and

one or more controllers for controlling the plurality of nozzles to dispense the plurality of flows based on a plurality of nozzle-specific parameters to create the pharmaceutical products, wherein the set of printing materials for creating the pharmaceutical products is heated to a first temperature in the flow distribution plate and heated to a second temperature higher than the first temperature in the plurality of nozzles.

2. The system of claim 1, further comprising a printing platform configured to receive the dispensed plurality of flows, wherein the printing platform is configured to move to form the pharmaceutical products.

3. The system of claim 1, wherein the material supply module is configured to plasticize the received set of printing materials and wherein the material supply module comprises a piston mechanism, a screw mechanism, a screw pump mechanism, a cogwheel mechanism, a plunger pump mechanism or any combination thereof.

4. The system of claim 1, wherein the plurality of channels forms a first juncture configured to divide the single flow into two flows.

5. The system of claim 4, wherein the plurality of channels forms a second juncture and a third juncture configured to divide the two flows into 4 flows.

6. The system of claim 1, wherein the flow distribution plate is split-able into a plurality of components to expose inner surfaces of the plurality of channels, wherein the plurality of components are configured to be held together via one or more screws.

7. The system of claim 1, wherein a nozzle of the plurality of nozzles comprises a heater, or wherein a nozzle of the plurality of nozzles comprises a thermal isolation structure.

8. The system of claim 1, wherein the plurality of nozzles comprises a plurality of needle-valve mechanisms, and wherein a needle-valve mechanism of the plurality of needle-valve mechanisms comprises:

a feed channel extending through the respective nozzle, wherein the feed channel is tapered at a distal end of the nozzle; and

a needle, wherein a distal end of the needle is configured to be in contact and seal the feed channel when the needle-valve mechanism is in a closed position, and wherein the distal end of the needle is configured to be retracted to allow a flow of printing materials to be dispensed.

9. The system of claim 8, wherein movement of the needle is driven by one or more actuators, or wherein the one or more actuators include a linear motor.

10. The system of claim 8, wherein the needle is a first needle, wherein the plurality of nozzles comprises a single plate coupled to the first needle and a second needle, and wherein movement of the single plate causes movement of the first needle and the second needle.

11. The system of claim 1, wherein a parameter of the plurality of nozzle-specific parameters comprises an amount of opening of a respective nozzle.

12. The system of claim 11, wherein the one or more controllers are configured to adjust the amount of opening of the respective nozzle based on a weight of a pharmaceutical product corresponding to the respective nozzle.

13. The system of claim 1, wherein the one or more controllers are configured to control temperature or pressure at the plurality of the nozzles.

14. The system of claim 1, wherein a temperature at the plurality of the nozzles is higher than a temperature at the materials supply module, or wherein a temperature at the plurality of the nozzles is higher than a temperature at the flow distribution plate.

15. The system of claim 1, wherein flow paths of the plurality of flows are geometrically symmetrical.

16. The system of claim 8, wherein the diameter of the plurality of channels of the flow distribution plate is larger than or equal to the diameter of feed channels of the plurality of nozzles.

17. The system of claim 16, wherein the material supply module is configured to transport the single flow to the flow distribution plate via a supply channel~~, and wherein the diameter of the supply channel is larger than the diameter of the plurality of channels of the flow distribution plate~~.

18. The system of claim 1, wherein the flow distribution plate is split-able and comprises a plurality of modules, wherein each module of the plurality of modules is configured to receive a flow and divide the flow into four flows to be dispensed by four nozzles of the plurality of nozzles.

19. A method for creating pharmaceutical products by additive manufacturing, comprising:

receiving, by a material supply module, a set of printing materials for creating the pharmaceutical products;

transporting a single flow corresponding to the set of printing materials to a flow distribution module comprising a flow distribution plate;

dividing, by a plurality of channels of the flow distribution plate, the single flow into a plurality of flows, wherein the set of printing materials is heated to a first temperature in the flow distribution plate;

receiving, by a plurality of nozzles, the plurality of flows;

heating, in the plurality of nozzles, the set of printing materials to a second temperature higher than the first temperature; and

controlling, by one or more controllers, the plurality of nozzles to dispense the plurality of flows based on a plurality of nozzle-specific parameters to create the pharmaceutical products.

20. The method of claim 19, further comprising:

receiving, by a printing platform, the dispensed plurality of flows, and

moving the printing platform to form the pharmaceutical products.

21. The method of claim 19, wherein the flow distribution plate is split-able into a plurality of components to expose inner surfaces of the plurality of channels, wherein the plurality of components are configured to be held together via one or more screws.

22. The method of claim 19, wherein the plurality of nozzles comprises a plurality of needle-valve mechanisms, and wherein a needle-valve mechanism of the plurality of needle-valve mechanisms comprises:

a feed channel extending through the respective nozzle, wherein the feed channel is tapered at a distal end of the nozzle; and

a needle, wherein a distal end of the needle is configured to be in contact and seal the feed channel when the needle-valve mechanism is in a closed position, and wherein the distal end of the needle is configured to be retracted to allow a flow of printing materials to be dispensed.

23. The method of claim 19, wherein a parameter of the plurality of nozzle-specific parameters comprises an amount of opening of a respective nozzle.

24. The method of claim 23, further comprising: adjusting, by the one or more controllers, the amount of opening of the respective nozzle based on a weight of a pharmaceutical product corresponding to the respective nozzle.

25. The method of claim 19, further comprising: controlling, by the one or more controllers, temperature or pressure at the plurality of the nozzles.

26. The method of claim 19, wherein a temperature at the plurality of the nozzles is higher than a temperature at the materials supply module.

27. The method of claim 19, wherein flow paths of the plurality of flows are geometrically symmetrical.

28. The method of claim 22, wherein the diameter of the plurality of channels of the flow distribution plate is larger than or equal to the diameter of feed channels of the plurality of nozzles.

29. The method of claim 28, wherein the material supply module is configured to transport the single flow to the flow distribution plate via a supply channel~~, and wherein the diameter of the supply channel is larger than the diameter of the plurality of channels of the flow distribution plate~~.

30. The method of claim 19, wherein the flow distribution plate is split-able and comprises a plurality of modules, wherein each module of the plurality of modules is configured to receive a flow and divide the flow into four flows to be dispensed by four nozzles of the plurality of nozzles.