Claims

1. A system for processing extrusion data during an extrusion process performed by an extruder under predefined extrusion parameters, the system comprising:

a set of pre-extrusion instruments for measuring, during the extrusion process, pre-extrusion properties of an extrudate within the extruder;

a set of post-extrusion instruments for measuring, during the extrusion process, post-extrusion properties of the extrudate after exiting the extruder; and

a processor for collecting the extrusion data comprising the extrusion parameters and the measured pre-extrusion and post-extrusion properties of the extrudate,

wherein the processor is configured for building a materials database using the extrusion data.

2. The system according to claim 1, wherein the pre-extrusion instruments and/or post-extrusion instruments are configured for measuring rheological properties of the extrudate.

3. The system according to claim 2, wherein the pre-extrusion instruments comprise one or more of a temperature sensor, pressure sensor, volume sensor, and torque sensor.

4. The system according to any one of claims 1 to 3, wherein the pre-extrusion instruments and/or post-extrusion instruments are configured for measuring morphological and/or chemical composition properties of the extrudate.

5. The system according to claim 4, wherein the pre-extrusion instruments and/or post-extrusion instruments comprise optical sensors including one or more of a Raman spectrometer, Fourier transform infrared spectrometer, colour spectrometer, ultraviolet spectrometer, X-ray scanner, and computed tomography scanner.

6. The system according to claim 5, wherein the post-extrusion instruments comprise an optical sensor for measuring die swell of the extrudate.

7. The system according to any one of claims 1 to 6, wherein the pre-extrusion instruments and/or post-extrusion instruments are configured for measuring mechanical performance properties of the extrudate.

8. The system according to claim 7, wherein the post-extrusion instruments comprise a melt tension instrument configured for measuring melt tension properties of the extrudate.

9. The system according to claim 13, wherein the post-extrusion instruments comprise a set of rollers configured for rolling the extrudate to facilitate measurement of the melt tension properties.

10. A method for processing extrusion data during an extrusion process, the method comprising:

performing the extrusion process using an extruder under predefined extrusion parameters;

measuring, during the extrusion process, and using a set of pre-extrusion instruments, pre-extrusion properties of an extrudate within the extruder;

measuring, during the extrusion process and using a set of post-extrusion instruments, post-extrusion properties of the extrudate after exiting the extruder;

collecting, using a processor, the extrusion data comprising the extrusion parameters and the measured pre-extrusion and post-extrusion properties of the extrudate; and

building a materials database using the processor and the extrusion data.

11. The method according to claim 10, further comprising reducing dimensionality of the extrusion data.

12. The method according to claim 10 or 11, further comprising training a machine learning model using the materials database.

13. The method according to claim 12, further comprising adjusting the extrusion parameters based on feedback received from the machine learning model.

14. The method according to claim 12 or 13, further comprising training, using the processor, the machine learning model to determine a set of output data based on a set of input data, the input data comprising extrusion parameters for an extrusion process and the output data comprising material properties of an extrudate created by the extrusion process.

15. The method according to claim 12 or 13, further comprising training, using the processor, the machine learning model to determine a set of output data based on a set of input data, the input data comprising material properties of an extrudate and the output data comprising extrusion parameters for an extrusion process to create the extrudate.

16. The method according to any one of claims 12 to 15, wherein the machine learning model is trained using a Bayesian optimization algorithm, a reinforcement learning algorithm, or a regression algorithm.

17. The method according to any one of claims 10 to 16, further comprising searching, using the machine learning model, the materials database based on a set of extrusion parameters for an extrusion process to create an extrudate and a set of material properties of the extrudate.

18. The method according to claim 17, further comprising adding, to the materials database, a new extrudate if an existing extrudate corresponding to the set of extrusion parameters and the set of material properties cannot be found in the materials database.

19. A computerized method for determining material properties of an extrudate, the method comprising:

providing a machine learning model trained with training data comprising a pre-established set of extrusion parameters and material properties of extrudates;

receiving, by the trained machine learning model, an input set of extrusion parameters for an extruder to create the extrudate;

processing the input set of extrusion parameters using the trained machine learning model; and

generating, by the trained machine learning model in response to said processing of the input set of extrusion parameters, an output set of the material properties of the extrudate.

20. The method according to claim 19, wherein the machine learning model is trained using a Bayesian optimization algorithm, a reinforcement learning algorithm, or a regression algorithm.

21. A computerized method for determining extrusion parameters for an extruder to create an extrudate, the method comprising:

providing a machine learning model trained with training data comprising a pre-established set of extrusion parameters and material properties of extrudates;

receiving, by the trained machine learning model, an input set of material properties of the extrudate;

processing the input set of material properties using the trained machine learning model; and

generating, by the trained machine learning model in response to said processing of the input set of material properties, an output set of the extrusion parameters for the extruder to create the extrudate.

22. The method according to claim 21, wherein the machine learning model is trained using a Bayesian optimization algorithm, a reinforcement learning algorithm, or a regression algorithm.