

CLAIMS

1. A method for training a machine learning model to predict metrology measurements of a current substrate being processed at a manufacturing system, the method comprising:

generating training data for the machine learning model, wherein generating the training data comprises:

generating a first training input comprising at least one of historical spectral data or historical non-spectral data associated with a portion of a prior substrate previously processed at the manufacturing system;

generating a second training input comprising historical positional data indicating the portion of the prior substrate associated with the at least one of the historical spectral data or the historical non-spectral data; and

generating a first target output for the first training input, wherein the first target output comprises historical metrology measurements associated with the prior substrate previously processed at the manufacturing system; and

providing the training data to train the machine learning model on (i) a set of training inputs comprising the first training input and the second training input, and (ii) a set of target outputs comprising the first target output.

2. The method of claim 1, wherein generating the first training input comprises: receiving, from a substrate measurement subsystem of the manufacturing system, a first set of measurements for the portion of the prior substrate, wherein the first set of measurements comprises the at least one of the historical spectral data or the historical non-spectral data for the portion of the prior substrate, and wherein the first training input is generated based on the received first set of measurements for the portion of the prior substrate.

3. The method of claim 1, wherein generating the first target output comprises: receiving, from a metrology system communicatively coupled to the manufacturing system, the historical metrology measurements associated with the prior substrate previously processed at the manufacturing system, wherein the first target output is generated based on the received historical metrology measurements.

4. The method of claim 1, wherein generating the first target output comprises: receiving, from a client device of the manufacturing system, the historical metrology measurements associated with the prior substrate previously processed at the manufacturing system, wherein the first target output is generated based on the received historical metrology measurements.

5. The method of claim 1, wherein generating the second training input comprises: receiving, from a substrate measurement subsystem, a first set of measurements for the portion of the prior substrate, wherein the first set of measurements comprises the at least one of the historical spectral data or the historical non-spectral data for the portion of the prior substrate and the historical positional data indicating the portion of the prior substrate associated with the at least one of the historical spectral data or the historical non-spectral data, and wherein the first training input is generated based on the received first set of measurements for the portion of the prior substrate.

6. The method of claim 1, wherein each training input of the set of training inputs is mapped to a target output of the set of target outputs.

7. The method of claim 1, wherein the machine learning model is configured to generate one or more outputs indicating a level of confidence of a metrology measurement for the current substrate being processed at the manufacturing system.

8. An apparatus comprising:
a memory to store a trained machine learning model; and
a processing device coupled to the memory, the processing device to:
provide one or more of spectral data or non-spectral data associated with a current substrate being processed at a manufacturing system as input to the trained machine learning model;
provide, with the one or more of the spectral data or the non-spectral data associated with the current substrate being processed at the manufacturing system, positional data indicating a portion of the substrate associated with the one or more of the spectral data or the non-spectral data as input to the trained machine learning model;

obtain one or more outputs from the trained machine learning model;
and extract, from the one or more outputs, a metrology measurement for the current substrate being processed at the manufacturing system.

9. The apparatus of claim 8, wherein the processing device is further to:
receive, from a substrate measurement subsystem of the manufacturing system, a set of measurements for a portion of a current substrate being processed at the manufacturing system, the set of measurements comprising the one or more of the spectral data or the non-spectral data.

10. The apparatus of claim 8, wherein the processing device is further to:
receive, from a substrate measurement subsystem of the manufacturing system, a set of measurements for a portion of a current substrate being processed at the manufacturing system, the set of measurements comprising the one or more of the spectral data or the non-spectral data and the positional data indicating the portion of the current substrate associated with the one or more of the spectral data or the non-spectral data.

11. The apparatus of claim 8, wherein the processing device is further to:
cause, via a client device of the manufacturing system, the metrology measurement for the current substrate being processed at the manufacturing system to be provided to a user of the manufacturing system via a graphical user interface (GUI).

12. The apparatus of claim 8, wherein the one or more outputs comprise (i) a metrology measurement for a prior substrate processed at the manufacturing system, and (ii) a level of confidence that the current substrate being processed at the manufacturing system is associated with the metrology measurement for the prior substrate.

13. The apparatus of claim 12, wherein, to extract the metrology measurement for the current substrate being processed at the manufacturing system from the one or more outputs, the processing device is to determine that the level of confidence satisfies a threshold condition.

14. The apparatus of claim 8, wherein the trained machine learning model is trained with an input-output mapping comprising an input and an output, the input based on at

least one of historical spectral data or historical non-spectral data associated with a surface of a prior substrate previously processed at the manufacturing system, and the output identifying a historical metrology measurement associated with the prior substrate previously processed at the manufacturing system.

15. A non-transitory computer readable storage medium comprising instructions that, when executed by a processing device, cause the processing device to:

receive one or more of input spectral data or input non-spectral data associated with a current substrate processed at a manufacturing system;

receive input positional data indicating a position of the current substrate processed at the manufacturing system;

process the one or more of the input spectral data or the input non-spectral data associated with the current substrate using a trained machine learning model, wherein the input positional data is processed with the one or more of the input spectral data or the input non-spectral data using the trained machine learning model; and

obtain, based on the processing of the one or more of the input spectral data or the input non-spectral data associated with the current substrate using the trained machine learning model, one or more outputs indicating a metrology measurement for the current substrate being processed at the manufacturing system.

16. The non-transitory computer readable storage medium of claim 15, wherein the one or more of the input spectral data or the input non-spectral data is received from a substrate measurement system of the manufacturing system.

17. The non-transitory computer readable storage medium of claim 15, wherein the processing device is further to:

cause, via a client device of the manufacturing system, the metrology measurement for the current substrate being processed at the manufacturing system to be provided to a user of the manufacturing system via a graphical user interface (GUI).