

within clean room environments where real estate or floor space is already expensive and at a premium.

[00012] Accordingly, it is desirable to improve substrate processing involving smaller circuit devices and features while maintaining the ability to qualify and monitor the process during production. It is desirable to reduce the number of junctures during fabrication wherein substrates are taken out of vacuum to atmosphere, and then must be subsequently placed back under vacuum in a processing chamber for further processing. It is further desirable to reduce the lag time between the process or substrate going out of specification, and the recognition of that issue by a fabricator or device maker so that they can respond more quickly. It is further desirable to continue to automate equipment and utilize process data to lessen human intervention in the fabrication process, leading to prescriptive optimization and full decision automation.

[00013] Therefore, there is an overall need to address the drawbacks in the current fabrication processes and equipment platforms.

SUMMARY

[00014] This disclosure relates to a high volume manufacturing platform which incorporates metrology instruments integrated to measure workpieces before and/or after being treated in the platform's processing chambers. Transfer chambers connected to the process chambers are integrated with the metrology sensors to enable measurements being done within the platform, and not a stand-alone metrology tool. In this instance, maintaining workpieces within the platform's controlled environment reduces the potential for added particles by reducing workpiece movement and minimizing the exposure of different environments to the workpiece.

[00014a] According to an ~~first~~ aspect of the present invention, there is provided a processing system for processing a workpiece for the fabrication of electronic devices thereon, the processing system comprising:

a plurality of processing ~~modules-chambers~~ for the fabrication of electronic devices in a processing sequence;

a workpiece transfer ~~module-chamber~~ coupled with the plurality of processing ~~chambers modules-and~~ comprising a workpiece transfer mechanism; and

a measurement module coupled with the workpiece transfer ~~chamber module~~ and including an inspection system operable for measuring data associated with an attribute of the workpiece that is being processed in the processing sequence, and

wherein at least a portion of the measurement module is positioned inside of an internal space of the workpiece transfer ~~module chamber~~, the measurement module including a measurement region located within a dedicated area of the internal space- and the workpiece transfer mechanism transfers a workpiece to the measurement region and supports the workpiece within the measurement region while the inspection system measures the data associated with an attribute of the workpiece.

[00014b] ~~According to a second aspect of the present invention, t~~There is provided a processing system, comprising:

a distributed transfer system comprising:
at least one internal vacuum chamber;
at least one substrate transfer mechanism disposed within the internal vacuum chamber;
a plurality of processing module ports disposed along the distributed transfer system;
a plurality of measurement inspection systems within the distributed transfer system;
one or more of film-forming modules, at least one of the film-forming modules coupled to a corresponding processing module port;
one or more etch modules, at least one of the etch modules coupled to a corresponding processing module port;
one or more cleaning modules, at least one of the cleaning modules coupled to a corresponding processing module port.

[00014c] ~~According to a third aspect of the present invention, t~~There is provided a processing system, comprising:

a distributed transfer system comprising:
at least one internal vacuum chamber;
at least one substrate transfer mechanism disposed within the internal vacuum chamber;
a plurality of processing module ports disposed along the distributed transfer system;
a plurality of measurement inspection systems within the distributed transfer system;
one or more film-forming modules, a film-forming module coupled to a corresponding processing module port;
one or more etch modules, an etch module coupled to a corresponding processing module port;
a batch processing module comprising a process chamber capable of simultaneously treating substrates; and
a staging chamber coupled to the batch processing module and the distributed transfer system, the staging chamber comprising a staging area to stage substrates for the batch processing chamber.

[00014d] ~~According to a fourth aspect of the present invention, there is provided a~~ manufacturing platform for processing a workpiece for the fabrication of electronic devices thereon, the processing system comprising, comprising:

5 a plurality of processing modules hosted on a common manufacturing platform, the processing modules configured for manipulating materials on a workpiece in processing steps as part of a processing sequence;

the plurality of processing modules including a first module and a second module, the first and second modules facilitating different processes in the process sequence;

10 at least one measurement module hosted on the common manufacturing platform, the measurement module including an inspection system operable for measuring data associated with an attribute of the workpiece at least one of before or after the workpiece is processed in a processing module of the common manufacturing platform;

15 at least one workpiece transfer module hosted on the common manufacturing platform and configured for the movement of the workpiece between the processing modules and the at least one measurement module;

an active interdiction control system hosted at least in part on the common manufacturing platform and coupled with the measurement module, the active interdiction control system configured for processing the measured data associated with an attribute on the workpiece for detecting non-conformities and configured to perform corrective processing of the workpiece at least in part in a processing module upstream and/or downstream in the process sequence when non-conformities are detected;

the active interdiction control system further configured for controlling movement and processing of the workpiece in the processing sequence;

25 the common manufacturing platform, the processing modules, and the measurement module operating in a controlled environment, and the workpiece transfer module configured for transferring the workpiece between the plurality of processing modules in the processing sequence and the measurement module without leaving the controlled environment.

[00014e] ~~According to a fifth aspect of the present invention, there is provided a method,~~ comprising:

30 processing a workpiece through a plurality of processing modules hosted on a common manufacturing platform, the workpiece comprising a plurality of electronic devices, wherein the processing includes performing a process sequence having at least one film-forming process and at least one etching process or film-treatment process;

35 gathering fabrication measurement data of the workpiece on the common manufacturing platform, wherein the fabrication measurement data is a measurement of an attribute of the workpiece based on at least a portion of the process sequence performed on the common manufacturing platform;

gathering in-situ process measurement data from a workpiece being processed in at least one of the processing modules that is performing a process of at least a portion of the process sequence;

5 detecting non-conformities of the workpiece based on at least one of the gathered fabrication measurement data or the in-situ process measurement data;

 performing active interdiction to the process sequence when non-conformities are detected to execute corrective processing of the workpiece in the process sequence on the common manufacturing platform after the measurement data has been gathered.

10 **[00015]** In one embodiment, a processing system for a workpiece for the fabrication of electronic devices includes a plurality of processing modules used to treat the workpieces and are arranged around one or more workpiece transfer modules which include a workpiece transfer mechanism to move the workpieces throughout the system in a predetermined processing sequence. In some instances, the processing
15 sequence will include a measurement step to monitor the state or condition of the workpiece for process control purposes. The system includes a measurement module coupled with the workpiece transfer module and including an inspection system operable for measuring data associated with an attribute of the workpiece that is being processed in the processing sequence. In most instances, at least a portion of the

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Claims:

1. A processing system for processing a workpiece for the fabrication of electronic devices thereon, the processing system comprising:

a plurality of processing ~~chambers~~ modules for the fabrication of electronic devices in a processing sequence;

a workpiece transfer ~~chamber~~ module coupled with the plurality of processing ~~chambers~~ modules ~~and~~ comprising a workpiece transfer mechanism; ~~and~~

a measurement module coupled with the workpiece transfer ~~chamber~~ module and including an inspection system operable for measuring data associated with an attribute of the workpiece that is being processed in the processing sequence, ~~and~~

wherein at least a portion of the measurement module is positioned inside of an internal space of the workpiece transfer ~~module~~ chamber, the measurement module including a measurement region located within a dedicated area of the internal space, and the workpiece transfer mechanism transfers a workpiece to the measurement region and supports the workpiece within the measurement region while the inspection system measures the data associated with an attribute of the workpiece.

2. The processing system of claim 1, wherein the ~~measurement module includes an inspection system that~~ measures data associated with one or more properties of a workpiece or data associated with one or more layers formed on a workpiece, the one or more properties including a physical property, a chemical property, an optical property, an electrical property, or a material property, or a combination of two or more thereof.

3. The processing system of claim 1 wherein the workpiece transfer ~~module~~ chamber includes a plurality of side ports through which a workpiece is moved to and from the plurality of processing ~~modules~~ chambers, the plurality of processing ~~modules~~ chambers including at least one etch ~~module~~ chambers and at least one film forming ~~chamber~~ module.

4. The processing system of claim 1 wherein the workpiece transfer ~~chamber~~ module includes a plurality of side ports through which a workpiece is moved to and from the plurality of processing ~~chambers~~ modules, the measurement module being

separate from the workpiece transfer ~~chamber module~~ and at least a portion thereof coupled with the workpiece transfer ~~chamber module~~ at a port formed in the top of the transfer module and above the plurality of side ports.

5. The processing system of claim 1 wherein the inspection system is operable for measuring data of a workpiece positioned in the measurement region at least one of before or after the workpiece is processed in a processing ~~chamber module~~.

6. The processing system of claim 1, further comprising:

a second transfer chamber having an internal space for the movement of the workpiece, the second transfer chamber being coupled to one or more additional processing ~~chambers modules~~ where the workpiece is processed;

a pass-through chamber having an internal space for the movement of the workpiece, the pass-through chamber positioned between the ~~workpiece~~ transfer chamber and the second transfer chamber;

an second measurement region located within a dedicated area of the pass-through chamber internal space, the second measurement region accessible by the transfer mechanism for positioning a workpiece in the second measurement region at least one of before or after the workpiece is processed in a processing ~~chamber module~~; and

an second inspection system configured to engage a workpiece that is positioned in the second measurement region, the inspection system operable for measuring data associated with an attribute on the workpiece.

7. The processing system of claim 1 wherein the workpiece transfer ~~module~~ ~~includes a transfer~~ mechanism ~~is~~ positioned inside an internal space of the workpiece transfer ~~chamber module~~, the ~~workpiece~~ transfer mechanism ~~being~~ configured to move a workpiece through the internal space and selectively into and out of the plurality of processing ~~chambers modules~~ and ~~into and out of~~ the measurement ~~region module~~.

8. The processing system of claim 1, the measurement ~~region module~~ including a support mechanism for supporting a workpiece positioned in the measurement ~~region module~~, the inspection system engaging the support mechanism for measuring

data associated with an attribute on a workpiece supported by the support mechanism.

9. The processing system of claim 8, wherein the support mechanism is configured to move the workpiece within at least two degrees of freedom for measuring data associated with an attribute of the workpiece.

10. The processing system of claim 8, wherein the support mechanism includes at least one temperature control element for controlling the workpiece temperature.

11. The processing system of claim 7, wherein the transfer mechanism is configured for positioning a workpiece in the measurement region module, the transfer mechanism moving the workpiece for engagement with the inspection system for measuring data associated with an attribute on the workpiece.

12. The processing system of claim 7, the measurement region module including a support mechanism for supporting a workpiece positioned in the measurement region module, the transfer mechanism configured for positioning the workpiece on support mechanism and the inspection system measuring data associated with an attribute on a workpiece supported by the support mechanism.

13. The processing system of claim 5, wherein the inspection system is positioned externally of the transfer chamber module internal space, the inspection system configured for engaging the workpiece by directing an inspection signal into the measurement region from outside the internal space for measuring data associated with an attribute on the workpiece.

14. The processing system of claim 13, further comprising an access port coupled with the workpiece transfer chamber module, the access port being transparent to the passage of the inspection signal from the inspection system into the internal space to the measurement region.

15. The processing system of claim 5, wherein the inspection system is positioned inside the transfer chamber module internal space and proximate the measurement

region, the inspection system engaging the workpiece by directing an inspection signal into the measurement region for measuring data associated with an attribute on the workpiece.

16. The processing system of claim 5, wherein the inspection system is positioned in the transfer chamber internal space and proximate the measurement region, the inspection system engaging the workpiece by physically contacting the workpiece or a support mechanism for measuring data associated with an attribute of the workpiece.

17. The processing system of claim 1 wherein the inspection system includes:

at least one signal source for directing at least one of an electromagnetic signal, an optical signal, a particle beam, or a charged particle beam to be incident onto a surface of a workpiece positioned in the measurement region; and
at least one detector arranged to receive at least one of electromagnetic signal, an optical signal, a particle beam, or a charged particle beam reflected from a surface of a workpiece for measuring data associated with an attribute on the workpiece.

18. The processing system of claim 1, wherein the inspection system is operable for measuring data associated with an attribute including one or more of the following: a layer thickness, a layer conformality, a layer coverage, a layer profile, an edge placement location, an edge placement error (EPE), a critical dimension (CD), a block critical dimension (CD), a grid critical dimension (CD), a line width roughness (LWR), a line edge roughness (LER), a block LWR, a grid LWR, a property relating to selective deposition, a property relating to selective etch, a physical property, an optical property, an electrical property, a refractive index, a resistance, a current, a voltage, a temperature, a mass, a velocity, an acceleration, or a combination thereof associated with fabricated electronic devices on the workpiece.

19. The processing system of claim 1, wherein the inspection system is operable for measuring data associated with an attribute of the workpiece using at least one of the following techniques or devices:

reflectometry, interferometry, scatterometry, profilometry, ellipsometry, X-ray photo-emission spectroscopy, ion scattering spectroscopy, low energy ion scattering (LEIS) spectroscopy, auger electron spectroscopy, secondary ion mass spectroscopy,

reflection absorption IR spectroscopy, electron beam inspection, particle inspection, particle counting device, optical inspection, dopant concentration metrology, film resistivity metrology, a micro-balance, an accelerometer, a voltage probe, a current probe, a temperature probe, a strain gage, or a combination thereof associated with fabricated electronic devices on the workpiece.

20. The processing system of claim 1, wherein the workpiece transfer chamber internal space and measurement ~~region module~~ are maintained as a controlled environment that includes at least one of a vacuum environment or an inert gas atmosphere.

21. The processing system of claim 6 wherein the plurality of processing ~~chambers modules~~ includes:

a first processing ~~chamber module~~ configured for performing a self-assembled monolayer (SAM) process;

a second processing ~~chamber module~~ configured for performing a film deposition process; and

a third processing ~~chamber module~~ configured for performing an etch process.

22. The processing system of claim 21 wherein the second processing ~~chamber module~~ is configured for performing a film deposition process by atomic layer deposition (ALD), plasma-enhanced ALD (PEALD), chemical vapor deposition (CVD), ~~or~~ plasma-enhanced CVD (PECVD), ~~or~~ Physical vapor deposition (PVD).

23. The processing system of claim 21 further comprising

a fourth processing chamber configured for performing a treatment process using a reactive treatment gas, heat-treating, or a combination thereof.

~~24. The processing system of claim 1, further comprising:~~

~~— a processing environment control system to maintain a first pressure in the measurement region, greater than a second pressure in the interior space, greater than a third pressure within a processing region of the one or more processing modules.~~

~~25. A processing system, comprising:~~

~~a distributed transfer system comprising:~~
~~at least one internal vacuum chamber;~~
~~at least one substrate transfer mechanism disposed within the~~
~~internal vacuum chamber;~~
~~a plurality of processing module ports disposed along the distributed~~
~~transfer system;~~
~~a plurality of measurement inspection systems within the distributed~~
~~transfer system;~~
~~one or more of film-forming modules, at least one of the film-forming~~
~~modules coupled to a corresponding processing module port;~~
~~one or more etch modules, at least one of the etch modules coupled to a~~
~~corresponding processing module port;~~
~~one or more cleaning modules, at least one of the cleaning modules coupled~~
~~to a corresponding processing module port.~~

26. ~~—The processing system of claim 25, wherein the internal vacuum chamber~~
~~comprises a plurality of internal vacuum chambers coupled together via substrate~~
~~pass-through ports and the substrate transfer mechanism comprises a plurality of~~
~~substrate handling components capable of moving substrates within the system.~~

27. ~~—The processing system of claim 25, further comprising a control system to~~
~~maintain a system pressure differential between the internal vacuum chambers~~
~~when the substrate is transferred within the distributed transfer system.~~

28. ~~—The processing system of claim 26, further comprising a control system to~~
~~maintain a treatment pressure differential between the distributed transfer system~~
~~and a chamber of a processing module when the substrate is transferred~~
~~between the distributed transfer system and the chamber.~~

29. ~~—The processing system of claim 28, wherein the control system is~~
~~operable to stage the substrates in staging areas within the internal vacuum~~
~~chamber until the system pressure differential or the treatment pressure~~
~~differential is achieved.~~

30. ~~_____The processing system of claim 25, further comprising a control system to maintain an environmental condition between the distributed transfer system and a chamber of a processing module when the substrate is transferred between the distributed transfer system and the chamber, the environmental conditions comprising at least one of pressure, gas composition, temperature, or phase concentration.~~
31. ~~_____The processing system of claim 25, further comprising a control system to maintain system environmental conditions between the internal vacuum chambers, the environmental conditions comprising at least one of chamber pressure, gas composition, temperature, or phase concentration.~~
32. ~~_____The processing system of claim 25, further comprising a control system to maintain system environmental conditions within the internal vacuum chamber based, at least in part, on a type of measurement process being performed on the substrate disposed within the internal vacuum chamber by a measurement inspection system, the environmental conditions comprising at least one of pressure, gas composition, temperature, or phase concentration.~~
33. ~~_____The processing system of claim 25, wherein the film-forming module comprises a vacuum deposition chamber or an atmospheric coating chamber.~~
34. ~~_____The processing system of claim 33, wherein the atmospheric coating chamber comprises a liquid dispensing system.~~
35. ~~_____The processing system of claim 33, wherein the vacuum deposition chamber comprises a plasma power source.~~
36. ~~_____The processing system of claim 33, wherein the vacuum deposition chamber or atmospheric coating chamber is coupled to a liquid source bubbler.~~
37. ~~_____The processing system of claim 33, wherein the vacuum deposition chamber comprises a sputter target.~~

- ~~38. The processing system of claim 33 wherein the vacuum deposition chamber is coupled to one or more film deposition gas sources.~~
- ~~39. The processing system of claim 25, wherein the etch module comprises a plasma power source.~~
- ~~40. The processing system of claim 25, wherein the etch module is coupled to a liquid dispensing system.~~
- ~~41. The processing system of claim 25, wherein the etch module is coupled to one or more etching gas sources.~~
- ~~42. The processing system of claim 25, wherein the cleaning module comprises a liquid vapor system.~~
- ~~43. The processing system of claim 42, wherein the liquid vapor system includes a liquid source bubbler capable of delivering gas with a liquid phase concentration of less than 1% by weight to a chamber of a cleaning module.~~
- ~~44. The processing system of claim 25, wherein the cleaning module is coupled to a cryogenic cooling system.~~
- ~~45. The processing system of claim 25, further comprising a load-lock mechanism coupled with at least one of the internal vacuum chambers for forming a staging area within the at least one internal vacuum chamber to store one or more substrates.~~
- ~~46. A processing system, comprising:
a distributed transfer system comprising:
at least one internal vacuum chamber;
at least one substrate transfer mechanism disposed within the internal vacuum chamber;~~

~~a plurality of processing module ports disposed along the distributed transfer system;~~

~~a plurality of measurement inspection systems within the distributed transfer system;~~

~~one or more film-forming modules, a film-forming module coupled to a corresponding processing module port;~~

~~one or more etch modules, an etch module coupled to a corresponding processing module port;~~

~~a batch processing module comprising a process chamber capable of simultaneously treating substrates; and~~

~~a staging chamber coupled to the batch processing module and the distributed transfer system, the staging chamber comprising a staging area to stage substrates for the batch processing chamber.~~

47. — The apparatus of claim 46, wherein the staging area comprises a storage area for a plurality of substrates.

48. — The apparatus of claim 46, further comprising one or more substrate cleaning chambers, the substrate cleaning chamber comprising a cleaning treatment chamber coupled to a corresponding processing module port.

49. — A manufacturing platform for processing a workpiece for the fabrication of electronic devices thereon, the processing system comprising, comprising:
— a plurality of processing modules hosted on a common manufacturing platform, the processing modules configured for manipulating materials on a workpiece in processing steps as part of a processing sequence;

the plurality of processing modules including a first module and a second module, the first and second modules facilitating different processes in the process sequence;

— at least one measurement module hosted on the common manufacturing platform, the measurement module including an inspection system operable for measuring data associated with an attribute of the workpiece at least one of before or after the workpiece is processed in a processing module of the common manufacturing platform;

~~at least one workpiece transfer module hosted on the common manufacturing platform and configured for the movement of the workpiece between the processing modules and the at least one measurement module;~~

~~——an active interdiction control system hosted at least in part on the common manufacturing platform and coupled with the measurement module, the active interdiction control system configured for processing the measured data associated with an attribute on the workpiece for detecting non-conformities and configured to perform corrective processing of the workpiece at least in part in a processing module upstream and/or downstream in the process sequence when non-conformities are detected;~~

~~——the active interdiction control system further configured for controlling movement and processing of the workpiece in the processing sequence;~~

~~——the common manufacturing platform, the processing modules, and the measurement module operating in a controlled environment, and the workpiece transfer module configured for transferring the workpiece between the plurality of processing modules in the processing sequence and the measurement module without leaving the controlled environment.~~

~~50.—The manufacturing platform of claim 49, wherein the first module is a film-forming module, and the second module is an etch module.~~

~~51.—The manufacturing platform of claim 49, wherein the active interdiction control system includes a pattern recognition component to extract and classify data patterns from the measured data, and predict the existence of a non-conformity.~~

~~52.—The manufacturing platform of claim 51, wherein the pattern recognition component comprises a deep learning architecture.~~

~~53.—The manufacturing platform of claim 52, wherein the pattern recognition component correlates an extracted data pattern with a learned attribute on the workpiece.~~

~~54.—The manufacturing platform of claim 53, wherein the learned attribute includes a defect on the workpiece.~~

~~55.—The manufacturing platform of claim 54, wherein the defect includes an out-of-tolerance condition for an attribute, the attribute including a thickness, a critical dimension, a surface roughness, a film or surface composition, a feature profile, a pattern edge placement, a void, a loss of selectivity, a measure of non-uniformity, or a loading effect, or any combination of two or more thereof.~~

~~56.—The manufacturing platform of claim 49, wherein the active interdiction control system further includes a display component to show a region of the workpiece where the non-conformity exists.~~

~~57.—The manufacturing platform of claim 49, wherein the active interdiction control system includes a correlation component to predict the existence of a non-conformity based upon a correlation of measured data at two or more locations on the workpiece.~~

~~58.—The manufacturing platform of claim 49, wherein the active interdiction control system includes an autonomous learning component that receives the measured data and generates knowledge based, at least in part, on (i) characterizes the measured data and performance of the process sequence, and (ii) decides an action plan to correct the process sequence in the event the non-conformity exists.~~

~~59.—The manufacturing platform of claim 58, wherein the autonomous learning component executes at least one of supervised learning, clustering, dimensionality reduction, structured prediction, anomaly detection, or reinforcement learning, or any combination of two or more thereof.~~

~~60.—The manufacturing platform of claim 49, wherein the active interdiction control system comprises:~~

~~an interaction component that receives the measured data, the interaction component including an adaptor component that packages the measured data and conveys packaged data;~~

~~an autonomous learning component that receives the packaged data and generates a knowledge that characterizes the packaged data and performance of the process sequence.~~

~~61.—The manufacturing platform of claim 60, wherein the autonomous learning component includes:~~

~~a processing platform that processes the packaged data, the processing platform includes a set of functional units that operate on the packaged data, wherein the set of functional units comprise:~~

~~an adaptive inference engine that analyzes the packaged data and infers an action to perform based at least in part on a process goal for the process sequence; and~~

~~a goal component that evolves the process goal based at least in part on one of data or a context change; and~~

~~a memory platform that stores the knowledge, the memory platform includes a hierarchy of memories that includes a long term memory, a short term memory, and an episodic memory, wherein the long term memory stores a set of concepts that includes at least one of an entity, a relationship, or a procedure, and wherein a concept in the set of concepts includes a first numeric attribute that indicates relevance of a concept to a current state of the process sequence, and a second numeric attribute that indicates a degree of difficulty to use the concept.~~

~~62.—The manufacturing platform of claim 61, wherein the interactive component further receives module diagnostic data from one or more of the plurality of the processing modules, and packages the module diagnostic data with the measured data when preparing the packaged data.~~

~~63.—The manufacturing platform of claim 61 wherein the interaction component further comprises an interaction manager that facilitates data exchange with an external actor.~~

~~64.—The manufacturing platform of claim 63, wherein at least one of packaged data or the data exchanged with the external actor includes training data.~~

~~65.—The manufacturing platform of 64, wherein the training data further includes at least one of an identification of a module process or variable associated with the task,~~

~~a functional relationship among two or more module processes or variables associated with the task, a causal graph that includes a set of *a priori* probabilities associated with a set of module processes or variables related to the task and present in the causal graph and a set of conditional probabilities that relate one or more module processes or variables related to the task and present in the causal graph, or a set of parameters that describe a behavior of the process sequence.~~

66.—A method, comprising:

~~——processing a workpiece through a plurality of processing modules hosted on a common manufacturing platform, the workpiece comprising a plurality of electronic devices, wherein the processing includes performing a process sequence having at least one film-forming process and at least one etching process or film-treatment process;~~

~~——gathering fabrication measurement data of the workpiece on the common manufacturing platform, wherein the fabrication measurement data is a measurement of an attribute of the workpiece based on at least a portion of the process sequence performed on the common manufacturing platform;~~

~~gathering in-situ process measurement data from a workpiece being processed in at least one of the processing modules that is performing a process of at least a portion of the process sequence;~~

~~detecting non-conformities of the workpiece based on at least one of the gathered fabrication measurement data or the in-situ process measurement data;~~

~~——performing active interdiction to the process sequence when non-conformities are detected to execute corrective processing of the workpiece in the process sequence on the common manufacturing platform after the measurement data has been gathered.~~

67.—The method of claim 66 wherein the corrective processing includes at least one of varying processing in a processing module on the common manufacturing platform, or discarding the workpiece, or notifying an operator of the non-conformity.

68.—The method of claim 67, wherein the gathering of in-situ process measurement data occurs in-situ in the processing module during a process step of the process sequence.

~~69.—The method of claim 68, wherein the corrective processing occurs in-situ in the same processing module where the in-situ process measurement data was obtained.~~

~~70.—The method of claim 66, wherein the gathering of fabrication measurement data occurs ex-situ of the processing module and within the common manufacturing platform.~~

~~71.—The method of claim 68, wherein the corrective processing occurs ex-situ of the processing module where the process measurement data was gathered and within the common manufacturing platform.~~

~~72.—The method of claim 66, further comprising:~~

~~——gathering at least one of process parameter data regarding the operation of one or more processing modules or platform performance data regarding the operation of the common manufacturing platform;~~

~~performing active interdiction to a process sequence of a subsequent workpiece based, on at least one of fabrication measurement data, the process parameter data, or the platform performance data.~~

~~73.—The method of claim 66, wherein active interdiction to a process sequence comprises exposing the workpiece to a remedial process sequence to correct the non-conformity.~~

~~74.—The method of claim 73, wherein the remedial process sequence comprises at least one of cleaning the workpiece, removing a film from the workpiece, or removing a portion of the film from the workpiece.~~

~~75.—The method of claim 73, wherein the remedial process sequence is performed on the common manufacturing platform.~~

~~76.—The method of claim 74, wherein the remedial process sequence is performed external to the common manufacturing platform.~~

~~77.—The method of claim 73, wherein the remedial process sequence comprises cleaning the workpiece using cryogenically cooled spray.~~

~~78.—The method of claim 66, wherein active interdiction to a process sequence comprises exposing the workpiece to an adjustment process sequence to modify the non-conformity detected.~~

~~79.—The method of claim 78, wherein the adjustment process sequence comprises controlling one or more process conditions based, at least in part, on fabrication measurement data or in-situ process measurement data from which a non-conformity is detected.~~

~~80.—The method of claim 78, wherein the adjustment process sequence comprises controlling one or more process conditions of a processing module based, at least in part, on a model corresponding to correction of the non-conformity.~~

~~81.—The method of claim 78, wherein the adjustment process comprises alternating between a film-forming process, an etching process, or a film-treatment process.~~

~~82.—The method of claim 66, further comprising gathering fabrication measurement data of the workpiece after performing active interdiction to determine impact on the non-conformity based on the active interdiction.~~

~~83.—The method of claim 82, further comprising continuing the process sequence for a workpiece based on the determined impact on the non-conformity.~~

~~84.—The method of claim 66, wherein the fabrication measurement data is a measurement associated with an attribute including one or more of the following: a layer thickness, a layer conformality, a layer coverage, a layer profile, an edge placement location, an edge placement error (EPE), a critical dimension (CD), a block critical dimension (CD), a grid critical dimension (CD), a line width roughness (LWR), a line edge roughness (LER), a block LWR, a grid LWR, a property relating to selective deposition, a property relating to selective etch, a physical property, an optical property, an electrical property, a refractive index, a resistance, a current, a voltage, a~~

~~temperature, a mass, a velocity, an acceleration, or a combination thereof associated with fabricated electronic devices on the workpiece.~~

~~85.—The method of claim 66, wherein the process parameter data comprises an indication of one or more process conditions executed in the processing modules.~~

~~86.—The method of claim 85, wherein the process conditions are based on at least one of plasma density, plasma uniformity, plasma temperature, etch rate, etch uniformity, deposition rate, and/or deposition uniformity.~~

~~87.—The method of claim 85, wherein the process conditions comprise at least one of amplitude, frequency, modulation of energy that is applied to a plasma source disposed within the processing module.~~

~~88.—The method of claim 85, wherein the process conditions comprise gas flow rates being flowed into the processing module during the process sequence.~~

~~89.—The method of claim 85, wherein the process conditions comprise temperature of a workpiece holder disposed within the processing module.~~

~~90.—The method of claim 85, wherein the process conditions comprise pressure in the process module during the process sequence.~~

~~91.—The method of claim 85, wherein the platform performance data comprises at least one of an indication of a platform attribute contributing to the execution of the process sequence or an indication of how long a process module has been exposed to the process sequence.~~

~~92.—The method of claim 86, wherein the platform attribute comprises process cooling water temperature, process cooling water flow rate, process module processing time, process module cumulative thickness.~~