

GCIB processing systems, suffer from poor throughput. In part, beam processing systems scan and process the entire workpiece, thus potentially treating areas of the workpiece not needing treatment, and fail to limit the beam scan to the target region for correction.

SUMMARY OF THE INVENTION

[0007] Embodiments of the invention relate generally to the fields of material processing and semiconductor integrated circuit manufacturing and, more specifically but not exclusively, to the location specific processing of various workpiece attributes.

[0008] According to a first aspect of the present invention, there is provided a method for performing location specific processing of a microelectronic workpiece, the method including: collecting parametric data relating to at least a portion of the microelectronic workpiece, the parametric data including a spatial profile of a measured attribute of the microelectronic workpiece; identifying a target region for corrective processing using the collected parametric data; placing the microelectronic workpiece in a beam processing system; selecting a beam scan size for a beam scan pattern that is smaller than a dimension of the microelectronic workpiece and based on a dimension of the target region; generating a processing beam; and processing the target region of the microelectronic workpiece by irradiating the processing beam along the beam scan pattern onto the target region within the beam scan size selected for processing the microelectronic workpiece.

[0009] According to a second aspect of the present invention, there is provided a processing system configured to perform location specific processing on a microelectronic workpiece, including: a beam processing system configured to treat a workpiece with a processing beam; and a multi-process controller programmably configured to: collect parametric data relating to at least a portion of the microelectronic workpiece, the parametric data including a spatial profile of a measured attribute of the microelectronic workpiece; identify a target region for corrective processing using the collected parametric data; select a beam scan size for a beam scan pattern that is smaller than a dimension of the microelectronic workpiece and based on a dimension of the target region; generate the processing beam; and process the target region of the microelectronic workpiece by irradiating the processing beam along the beam scan pattern onto the target region within the beam scan size selected for processing the microelectronic workpiece.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

[0010] FIG. 1A illustrates a conventional beam scan pattern on a workpiece to be processed

[0011] FIGs. 1B through 1C illustrate different beam scan patterns on a workpiece to be processed according to various embodiments;

[0012] FIG. 2 is a flow chart illustrating a method for processing a workpiece according to an embodiment;

[0013] FIG. 3 provides an illustration of a corrective processing system according to an embodiment; and

CLAIMS:

1. A method for performing location specific processing of a microelectronic workpiece, the method comprising:

collecting parametric data relating to at least a portion of the microelectronic workpiece, the parametric data including a spatial profile of a measured attribute of the microelectronic workpiece;

identifying a target region for corrective processing using the collected parametric data;

placing the microelectronic workpiece in a beam processing system;

selecting a beam scan size for a beam scan pattern that is smaller than a dimension of the microelectronic workpiece and based on a dimension of the target region;

generating a processing beam; and

processing the target region of the microelectronic workpiece by irradiating the processing beam along the beam scan pattern onto the target region within the beam scan size selected for processing the microelectronic workpiece.

2. The method of claim 1, wherein the processing includes:

scanning the microelectronic workpiece through the processing beam; and

confining a spatial range of the scanning within the beam scan size selected for processing the microelectronic workpiece.

3. The method of claim 1, wherein the processing includes:

scanning the processing beam across the microelectronic workpiece; and

confining a spatial range of the scanning within the beam scan size selected for processing the microelectronic workpiece.

4. The method of claim 1, wherein the microelectronic workpiece includes a semiconductor substrate and the dimension of the microelectronic workpiece is a diameter, or wherein the microelectronic workpiece includes a flat panel display or device, and the dimension of the microelectronic workpiece is a width or length of the panel.

5. The method of claim 1, wherein the processing beam includes a neutral beam, a gas cluster beam (GCB), or a gas cluster ion beam (GCIB), or any portion thereof, or any combination thereof.

6. The method of claim 1, further comprising:
determining a position for the beam scan pattern on the microelectronic workpiece based on the location of the target region.

7. The method of claim 6, wherein the beam scan size and the position of the beam scan pattern are selected such that the beam scan pattern fully covers the target region and the beam scan size exceeds the size of the target region by no more than 50% based upon areal size.

8. The method of claim 6, further comprising:
spatially modulating an applied property of the processing beam, based at least in part on the parametric data, as a function of position on the microelectronic workpiece to achieve a target profile of the measured attribute.

9. The method of claim 8, wherein the measured attribute comprises a film thickness, a surface roughness, a surface contamination, a feature depth, a trench depth, a via depth, a feature width, a trench width, a via width, a critical dimension (CD), a surface roughness, or an electrical resistance, or any combination of two or more thereof.

10. The method of claim 8, wherein the applied property of the processing beam includes a beam dose.

11. The method of claim 8, wherein the applied property of the processing beam includes a beam dose, a beam area, a beam profile, a beam intensity, a beam scanning rate, or a dwell time, or any combination of two or more thereof.

12. The method of claim 1, wherein the processing beam performs an etch process, a deposition process, a growth process, a smoothing process, a doping process, a modification process, or any combination of two or more thereof to achieve a target profile of an attribute of the microelectronic workpiece.

13. A processing system configured to perform location specific processing on a microelectronic workpiece, comprising:
a beam processing system configured to treat a workpiece with a processing beam; and
a multi-process controller programmably configured to:

collect parametric data relating to at least a portion of the microelectronic workpiece, the parametric data including a spatial profile of a measured attribute of the microelectronic workpiece;

identify a target region for corrective processing using the collected parametric data;

select a beam scan size for a beam scan pattern that is smaller than a dimension of the microelectronic workpiece and based on a dimension of the target region;

generate the processing beam; and

process the target region of the microelectronic workpiece by irradiating the processing beam along the beam scan pattern onto the target region within the beam scan size selected for processing the microelectronic workpiece.

14. The system of claim 13, wherein the processing beam includes a neutral beam, a gas cluster beam (GCB), or a gas cluster ion beam (GCIB), or any portion thereof.

15. The system of claim 13, wherein the multi-process controller is further programmably configured to execute the following:

determining a position for the beam scan pattern on the microelectronic workpiece based on the location of the target region.

16. The system of claim 13, wherein the multi-process controller is further programmably configured to execute the following:

spatially modulate an applied property of the processing beam, based at least in part on the parametric data, as a function of position on the microelectronic workpiece to achieve a target profile of the measured attribute.

17. The system of claim 13, further comprising:

a metrology system configured to collect the parametric data for one or more workpieces.

18. The system of claim 13, further comprising:

a scanner arranged within the beam processing system to scan a workpiece holder that holds the microelectronic workpiece through the processing beam within a spatial range defined by the beam scan size.