CLAIMS

1. A system comprising:

an electron beam source that generates an electron beam, wherein the electron beam source includes a tip, a suppression electrode, and an extraction electrode;

a stage configured to hold a wafer in a path of the electron beam;

an objective lens in the path of the electron beam, wherein the objective lens includes:

an upper pole piece;

a lower pole piece;

an objective lens coil disposed on the upper pole piece;

a charge control plate disposed on the lower pole piece;

an acceleration electrode disposed in the path of the electron beam between the upper pole piece and the lower pole piece; and

a scanner disposed on the upper pole piece;

a Wien filter in the path of the electron beam between the objective lens and the electron beam source;

a transfer lens in the path of the electron beam between the Wien filter and the electron beam source, wherein the transfer lens includes a pole piece and a transfer lens coil; and

a detection array configured to receive at least one secondary electron beam from the wafer on the stage.

2. The system of claim 1, wherein the Wien filter includes an electrostatic deflector and a magnetic deflector.

3. The system of claim 1, further comprising:

a collimation lens in the path of the electron beam; and

a beam limiting aperture in the path of the electron beam between the collimation lens and the electron beam source.

4. The system of claim 1, further comprising:

an aperture array disposed in the path of the electron beam, wherein the aperture array splits the electron beam into a plurality of beamlets;

a micro stigmator array disposed in the path of the electron beam between the aperture array and the transfer lens;

a micro deflector array disposed in the path of the electron beam between the micro stigmator array and the transfer lens; and

a micro lens array disposed in the path of the electron beam between the micro deflector array and the transfer lens.

5. The system of claim 4, wherein the plurality of beamlets includes at least 100 of the beamlets.

6. The system of claim 4, wherein the electron beam is a telecentric beam upstream of the aperture array.

7. The system of claim 1, wherein the path of the electron beam is at a first orientation leaving the transfer lens and at a second orientation different from the first orientation leaving the Wien filter such that the first orientation is at a non-parallel angle to the second orientation.

8. The system of claim 1, further comprising a second Wien filter in the path of the electron beam between the Wien filter and the transfer lens.

9. The system of claim 8, wherein the second Wien filter includes a second electrostatic deflector and a second magnetic deflector.

10. A method comprising:

directing a plurality of beamlets through a transfer lens downstream of an electron beam source thereby focusing the plurality of beamlets;

directing the beamlets through a Wien filter downstream of the transfer lens thereby separating at least one secondary electron beam from the beamlets;

directing the beamlets through an upper pole piece of an objective lens, wherein the objective lens is downstream of the Wien filter;

directing the beamlets through an acceleration electrode downstream of the upper pole piece;

directing the beamlets through a charge control plate disposed in a lower pole piece of the objective lens, wherein the charge control plate is disposed on an opposite side of the objective lens from the upper pole piece;

directing the beamlets at a wafer; and

receiving the at least one secondary electron beam from the wafer at a detection array.

11. The method of claim 10, wherein the plurality of beamlets includes at least 100 of the beamlets.

12. The method of claim 10, further comprising:

generating an electron beam using the electron beam source; and

converting the electron beam into the plurality of beamlets.

13. The method of claim 12, further comprising:

directing the electron beam through a collimation lens and a beam limiting aperture disposed in a path of the electron beam between the electron beam source and the transfer lens.

14. The method of claim 10, further comprising scanning the beamlets with a scanner disposed on the upper pole piece.

15. The method of claim 10, wherein the Wien filter includes an electrostatic deflector and a magnetic deflector.

16. The method of claim 10, further comprising:

splitting an electron beam into the beamlets using an aperture array, wherein the aperture array is disposed in a path of the electron beam between the electron beam source and the transfer lens;

directing the beamlets through a micro stigmator array disposed in the path of the beamlets between the aperture array and the transfer lens;

directing the beamlets through a micro deflector array disposed in the path of the beamlets between the micro stigmator array and the transfer lens; and

directing the beamlets through a micro lens array disposed in the path of the beamlets between the micro deflector array and the transfer lens.

17. The method of claim 16, wherein the plurality of beamlets includes at least 100 of the beamlets.

18. The method of claim 16, wherein the electron beam is a telecentric beam upstream of the aperture array.

19. The method of claim 10, further comprising changing a direction of the beamlets using the Wien filter such that the beamlets are directed at an angle leaving the Wien filter relative to their orientation entering the Wien filter.

20. The method of claim 10, further comprising directing the beamlets through a second Wien filter in a path of the beamlets between the Wien filter and the transfer lens.

21. The method of claim 10, wherein the acceleration electrode is configured to change the resolution of the beamlets.

22. The method of claim 10, wherein the Wien filter is configured to adjust dispersion and astigmatism for the beamlets simultaneously.