

What is claimed:

1. A scanning electron microscopy apparatus comprising:
 - a sample stage configured to secure a sample including one or more conducting structures disposed on insulating material;
 - an electron-optical column comprising:
 - an electron source configured to generate a primary electron beam; and
 - a set of electron-optical elements configured to direct at least a portion of the primary electron beam onto a portion of the sample;
 - a detector assembly configured to detect electrons emanating from the surface of the sample; and
 - a controller communicatively coupled to the detector assembly, the controller including one or more processors configured to execute program instructions maintained in memory, the program instructions configured to cause the one or more processors to:
 - direct the electron-optical column to perform, with the primary electron beam, an alternating series of image scans and flood scans of the portion of the sample, wherein each of the flood scans are performed sequential to one or more of the imaging scans.
2. The apparatus of claim 1, wherein the series of image scans is used to form a final image.
3. The apparatus of claim 1, wherein the series of flood scans is discarded.
4. The apparatus of claim 1, wherein one or more imaging frames are acquired at a first landing energy.

5. The apparatus of claim 1, wherein one or more flood frames are acquired at an additional landing energy.
6. The apparatus of claim 1, wherein the set of electron-optical elements comprises:
 - a condenser lens.
7. The apparatus of claim 1, wherein the set of electron-optical elements comprises:
 - an objective lens.
8. The apparatus of claim 1, wherein the set of electron-optical elements comprises:
 - a set of scanning elements.
9. The apparatus of claim 1, wherein the electron beam source comprises:
 - one or more electron guns.
10. The apparatus of claim 1, wherein the detector assembly comprises:
 - at least one of a secondary electron detector or a backscattered electron detector.
11. The apparatus of claim 1, further comprising:
 - bias control circuitry configured to control a bias of the stage.
12. The apparatus of claim 1, wherein the controller is configured to adjust at least one of one or more one or more components of the electron-optical column or the bias control circuitry in order to perform at least one of the imaging scans and the flood scans.

13. The apparatus of claim 1, further comprising:
a vacuum system.
14. A scanning electron microscopy apparatus comprising:
a sample stage configured to secure a sample including one or more conducting structures disposed on insulating material;
an electron-optical column comprising:
an electron source configured to generate a primary electron beam; and
a set of electron-optical elements configured to direct at least a portion of the primary electron beam onto a portion of the sample;
a detector assembly configured to detect electrons emanating from the surface of the sample; and
a controller communicatively coupled to the detector assembly, the controller including one or more processors configured to execute program instructions maintained in memory, the program instructions configured to cause the one or more processors to:
direct the electron-optical column to perform, with the primary electron beam, an alternating series of exposures of the portion of the sample, wherein the alternating series of exposures includes a first set of exposures performed at a first electron landing energy and an additional set of exposures performed at an additional landing energy less than the first landing energy, wherein each of the exposures of the additional set of exposures are performed sequential to one or more exposures of the first set of exposures.
15. The apparatus of claim 14, wherein the alternating series of exposures of the portion of the sample includes a series of N exposures alternating between the first electron landing energy and the additional electron landing energy.

16. The apparatus of claim 14, wherein the alternating series of exposures of the portion of the sample causes surface charge neutralization at a surface of the sample.
17. The apparatus of claim 14, wherein the first landing energy is equal to or greater than 50 eV.
18. The apparatus of claim 14, wherein the additional landing energy is less than 1 eV.
19. The apparatus of claim 14, wherein the controller directs the electron-optical column to achieve the first landing energy of the primary electron beam by maintaining the sample at a voltage at least 5 kV more positive than a voltage of a cathode of the electron source.
20. The apparatus of claim 14, wherein the controller directs the electron-optical column to achieve the additional landing energy of the primary electron beam by maintaining the sample at a voltage less than 10 V more positive than a voltage of a cathode of the electron source.
21. The apparatus of claim 14, wherein one or more imaging frames are acquired at the first landing energy.
22. The apparatus of claim 14, wherein one or more flood frames are acquired at the additional landing energy.
23. The apparatus of claim 14, wherein a single cathode of the electron source generates the primary electron beam having the first landing energy and the primary electron beam having the additional landing energy.

24. The apparatus of claim 14, wherein a single cathode of the electron source generates the primary electron beam having the first landing energy and the primary electron beam having the additional landing energy.
25. The apparatus of claim 14, wherein the set of electron-optical elements comprises:
a condenser lens.
26. The apparatus of claim 14, wherein the set of electron-optical elements comprises:
an objective lens.
27. The apparatus of claim 14, wherein the set of electron-optical elements comprises:
a set of scanning elements.
28. The apparatus of claim 14, wherein the electron beam source comprises:
one or more electron guns.
29. The apparatus of claim 14, wherein the detector assembly comprises:
at least one of a secondary electron detector or a backscattered electron detector.
30. The apparatus of claim 14, further comprising:
bias control circuitry configured to control a bias of the stage.
31. The apparatus of claim 14, wherein the controller is configured to adjust at least one of one or more one or more components of the electron-optical column or the bias control circuitry in order to establish at least one of the first landing energy or the additional landing energy.

32. The apparatus of claim 14, further comprising:
a vacuum system.
33. A scanning electron microscopy apparatus comprising:
a sample stage configured to secure a sample including one or more conducting structures disposed on insulating material;
an electron-optical column comprising:
an electron source configured to generate a primary electron beam; and
a set of electron-optical elements configured to direct at least a portion of the primary electron beam onto a portion of the sample;
a detector assembly configured to detect electrons emanating from the surface of the sample; and
a controller communicatively coupled to the detector assembly, the controller including one or more processors configured to execute program instructions maintained in memory, the program instructions configured to cause the one or more processors to:
direct the electron-optical column to perform, with the primary electron beam, an alternating series of exposures of the portion of the sample, wherein the alternating series of exposures includes a first set of exposures performed at a first electron extraction field and an additional set of exposures performed at an additional electron extraction field, wherein each of the exposures of the additional set of exposures are performed sequential to one or more exposures of the first set of exposures.
34. The apparatus of claim 33, wherein the alternating series of exposures of the portion of the sample includes a series of N exposures alternating between the first electron extraction field and the additional electron extraction field.

35. The apparatus of claim 33, wherein a landing energy is held constant during image acquisition.

36. The apparatus of claim 33, wherein the alternating series of exposures of the portion of the sample causes surface charge neutralization at a surface of the sample.

37. The apparatus of claim 33, wherein the first electron extraction field is larger than the additional electron extraction field.

38. The apparatus of claim 37, wherein the first electron extraction field is between 100 and 3000 Volts/mm.

39. The apparatus of claim 37, wherein the additional electron extraction field is less than 0 Volts/mm.

40. The apparatus of claim 33, wherein the first electron extraction field is established by maintaining an objective lens of the electron-optical column at a voltage substantially more positive than the voltage of the sample.

41. The apparatus of claim 33, wherein the additional electron extraction field is established by maintaining an objective lens of the electron-optical column at a voltage more negative than the voltage of the sample.

42. The apparatus of claim 41 wherein electrons repelled by the objective lens maintain at a voltage more negative than the voltage of the sample repels electrons from the objective and causes surface charge neutralization of the sample.

43. The apparatus of claim 33, wherein one or more imaging frames are acquired at the first electron extraction field.
44. The apparatus of claim 33, wherein one or more flood frames are acquired at the additional electron extraction field.
45. The apparatus of claim 33, wherein the set of electron-optical elements comprises:
a condenser lens.
46. The apparatus of claim 33, wherein the set of electron-optical elements comprises:
an objective lens.
47. The apparatus of claim 33, wherein the set of electron-optical elements comprises:
a set of scanning elements.
48. The apparatus of claim 33, wherein the electron beam source comprises:
one or more electron guns.
49. The apparatus of claim 33, wherein the detector assembly comprises:
at least one of a secondary electron detector or a backscattered electron detector.
50. The apparatus of claim 33, further comprising:
bias control circuitry configured to control a bias of the stage.
51. The apparatus of claim 33, further comprising:
a vacuum system.

52. A method comprising:

performing, with an electron beam, an alternating series of image scans and flood scans of a portion of a sample, wherein each of the flood scans are performed sequential to one or more of the imaging scans.

53. A method comprising:

performing, with an electron beam, an alternating series of exposures of a portion of a sample, wherein the alternating series of exposures includes a first set of exposures performed at a first electron landing energy and an additional set of exposures performed at an additional landing energy less than the first landing energy, wherein each of the exposures of the additional set of exposures are performed sequential to one or more exposures of the first set of exposures.

54. A method comprising:

performing, with an electron beam, an alternating series of exposures of a portion of a sample, wherein the alternating series of exposures includes a first set of exposures performed at a first electron extraction field and an additional set of exposures performed at an additional electron extraction field, wherein each of the exposures of the additional set of exposures are performed sequential to one or more exposures of the first set of exposures.