CLAIMS

1. A charged particle beam device, comprising:

a charged particle beam source situated in a first-pressure environment;

a sample support operative to support a sample, said sample support and said sample situated in a second-pressure environment, said second-pressure environment having a higher pressure than said first-pressure environment; and

a membrane assembly separating said first-pressure environment from said second-pressure environment, said membrane assembly comprising:

a pressure-sealing membrane being substantially transparent to a charged particle beam from said charged particle beam source;

a supporting membrane layer being formed with a cornerless aperture having a longest chord of at least 100,000 nanometers, said pressure-sealing membrane being bonded to said supporting membrane layer; and

a holding frame being formed with a second aperture larger than and overlying said cornerless aperture.

2. A charged particle beam device according to claim **1**, wherein said membrane assembly further comprises an electron detecting subassembly, said electron-detecting subassembly comprising:

at least one metal line defining a shape, for detection of electrons resulting from an interaction of said charged particle beam and sample.

3. A charged particle beam device according to claim **2**, wherein said electron-detecting subassembly comprises:

at least two metal lines each defining a shape, said shapes being mutually spaced and mutually nested, for detection of electrons resulting from an interaction of said charged particle beam and said sample.

4. A charged particle beam device according to claim **1** wherein:

said pressure-sealing membrane and said supporting membrane layer are substantially transparent to X-rays.

5. A charged particle beam device according to claim **4,** wherein said membrane assembly further comprises an electron-detecting subassembly, said electron-detecting subassembly comprising:

at least two metal lines each defining a shape, said shapes being mutually spaced and mutually nested, for detection of electrons resulting from an interaction of said charged particle beam and said sample, at least one of said metal lines partially overlying an area defined by said second aperture.

6. A charged particle beam device according to claim **1** wherein said second-pressure environment is at substantially atmospheric pressure.

7. A charged particle beam device according to claim **1** wherein said pressure-sealing membrane is disposed between and bonded to said supporting membrane layer and said holding frame.

8. A charged particle beam device according to claim **1** wherein said supporting membrane layer is disposed between and bonded to said pressure-sealing membrane and said holding frame.

9. A charged particle beam device according to claim **1** wherein said supporting membrane layer is less than 10,000 nanometers thick.

10. A charged particle beam device according to claim **1** wherein said cornerless aperture has a longest chord of at least 250,000 nanometers.

11. A membrane assembly comprising:

a pressure-sealing membrane suitable for separating a first-pressure environment from a second-pressure environment, said second-pressure environment having a different pressure to said first-pressure environment, said pressure-sealing membrane having a thickness of less than 20 nanometers and being substantially transparent to electrons;

a supporting membrane layer being formed with a cornerless aperture having a longest chord of at least 100,000 nanometers, said pressure-sealing membrane being bonded to said supporting membrane layer; and

a holding frame being formed with a second aperture larger than and overlying said cornerless aperture.

12. A membrane assembly according to claim **11** further comprising an electron-detecting subassembly, said electron-detecting subassembly comprising:

at least one shaped metal line, for detection of electrons.

13. A membrane assembly according to claim **11**, wherein said electron-detecting subassembly comprises:

at least two metal lines each defining a shape, said shapes being mutually nested and mutually spaced, for detection of electrons.

14. A membrane assembly according to claim **11** wherein:

said pressure-sealing membrane and said supporting membrane layer are substantially transparent to X-rays.

15. A membrane assembly according to claim **14**, further comprising an electron-detecting subassembly, said electron-detecting subassembly comprising:

at least two metal lines each defining a shape, said shapes being mutually nested and mutually spaced, for detection of electrons, at least one of said metal lines partially overlying an area defined by said second aperture.

16. A membrane assembly according to claim **11** wherein said pressure-sealing membrane is disposed between and bonded to said supporting membrane layer and said holding frame.

17. A membrane assembly according to claim **11** wherein said supporting membrane layer is disposed between and bonded to said pressure-sealing membrane and said holding frame.

18. A membrane assembly according to claim **11** wherein said supporting membrane layer is less than 10,000 nanometers thick.

19. A membrane assembly according to claim **11** wherein said cornerless aperture has a longest chord of at least 250,000 nanometers.

20. A charged particle beam device, comprising:

a charged particle beam source situated in a first-pressure environment;

a region transparent to a charged particle beam from said charged particle beam source;

a sample support operative to support a sample, said sample support and said sample situated in a second-pressure environment, said second-pressure environment being at a higher pressure than said first-pressure environment and said second-pressure environment being at atmospheric pressure;

a membrane assembly separating said second-pressure environment from said first-pressure environment, said membrane assembly comprising:

a pressure-sealing membrane being substantially transparent to a charged particle beam from said charged particle beam source;

a supporting membrane layer being formed with a cornerless aperture having a longest chord of at least 100,000 nanometers, and said pressure-sealing membrane being bonded to said supporting membrane layer; and

a holding frame being formed with a second aperture larger than and overlying said cornerless aperture; and

an electron-detecting subassembly situated in said second-pressure environment, said electron-detecting subassembly comprising at least two metal lines each defining a shape, said shapes being mutually spaced and mutually nested, for detection of electrons.

21. A charged particle beam device according to claim **20** wherein said metal lines are each electrically connected to a metal pad, a distance between said sample and each of said metal pads being greater than a distance between said sample and each of said metal lines.

22. A charged particle beam device according to claim **20** and wherein at least one of said metal lines partially overlies an area defined by said second aperture.

23. A charged particle beam devise according to claim **20** wherein said cornerless aperture has a longest chord at least 250,000 nanometers.