CLAIMS

1. A method for manufacturing a superconducting device, the method comprising acts of:

forming at least one trough in at least a first substrate;

covering at least a portion of the first substrate with a superconducting material;

covering at least a portion of a second substrate with the superconducting material; and

bonding the first substrate and the second substrate to form at least one enclosure comprising the at least one trough and the superconducting material,

wherein the act of covering at least a portion of the first substrate with a superconducting material comprises acts of:

forming a seed layer on at least the portion of the first substrate; and

electroplating the superconducting material onto the seed layer.

2. The method of claim 1, wherein the act of forming the at least one trough comprises acts of:

forming a mask layer that covers a portion of the first substrate; and

etching a portion of the first substrate not covered by the mask layer.

3. The method of claim 2, wherein the act of etching comprises an act of anisotropic etching.

4. The method of claim 3, wherein the act of anisotropic etching uses a wet etchant.

5. The method of claim 2, wherein the mask layer comprises silicon nitride.

6. The method of claim 1, wherein the superconducting material is selected from the group consisting of aluminum, niobium, indium, rhenium, tantalum, titanium nitride, and niobium nitride.

7. A method for manufacturing a superconducting device, the method comprising acts of:

forming at least one trough in at least a first substrate;

covering at least a portion of the first substrate with a superconducting material;

covering at least a portion of a second substrate with the superconducting material;

bonding the first substrate and the second substrate to form at least one enclosure comprising the at least one trough and the superconducting material;

forming channels in at least one wiring layer substrate;

covering at least a portion of the channels with the superconducting material to form a wiring layer; and

bonding the at least one wiring substrate to the first substrate and/or the second substrate.

8. The method of claim 7, wherein the act of forming at least one trough in at least a first substrate comprises:

forming a first trough in the first substrate; and

forming a second trough in the second substrate, wherein the at least one enclosure comprises a first enclosure formed from the first trough and the second trough.

9. The method of claim 8, wherein the at least one enclosure is configured to form at least one electromagnetic shield such that external electromagnetic radiation is prevented from entering the at least one enclosure.

10. The method of claim 9, further comprising:

forming at least one superconducting component within the first enclosure.

11. The method of claim 10, wherein the at least one superconducting component comprises at least one superconducting circuit.

12. The method of claim 10, wherein the at least one superconducting component comprises at least one qubit.

13. The method of claim 12, further comprising:

covering at least a portion of said second substrate with a support layer, wherein the at least one qubit is disposed on and/or within the support layer.

14. The method of claim 12, wherein the at least one superconducting component comprises at least one stripline resonator.

15. The method of claim 14, wherein the act of forming at least one trough in at least a first substrate further comprises forming a third trough in a third substrate, the method further comprising:

covering at least a portion of the third substrate with the superconducting material;

covering at least a portion of a fourth substrate with the superconducting material;

bonding the third substrate and the fourth substrate to form a memory layer comprising a second enclosure from the third trough; and

bonding the memory layer to the at least one wiring layer.

16. The method of claim 15, wherein:

the wiring layer couples the second enclosure to the first enclosure.

17. The method of claim 16, wherein:

the first enclosure is electrically connected to the wiring layer through at least one via.

18. The method of claim 15, wherein:

a Q factor of the second enclosure is greater than a Q factor of the first enclosure.

19. The method of claim 1, further comprising:

coupling at least one qubit to the at least one enclosure.

20. The method of claim 19, wherein coupling the at least one qubit to the at least one enclosure comprises forming the at least one qubit within the at least one enclosure.

21. The method of claim 19, wherein the at least one qubit is a transmon qubit.

22. The method of claim 19, wherein the at least one qubit is a fluxonium qubit.

23. The method of claim 1 or claim 7, wherein the at least one enclosure is configured to form at least one three-dimensional cavity resonator such that electromagnetic radiation at one or more frequencies resonates within the at least one three-dimensional cavity resonator.