

Claims

1. A method of charging and/or discharging an electrochemical cell, wherein the electrochemical cell comprises a working electrode having a surface layer of niobium-containing metal oxide disposed on a secondary active electrode material, and wherein the temperature of the electrochemical cell is 45 °C or more, such as 50 °C or more, 55 °C or more or 60 °C or more.
2. A method of charging and/or discharging an electrochemical cell, wherein the electrochemical cell comprises a working electrode having a surface layer of niobium-containing metal oxide disposed on a secondary active electrode material, and wherein the temperature of the electrochemical cell is 10 °C or less, such as 5 °C or less or 0 °C or less.
3. The method of claim 1 or 2, wherein the working electrode is an anode.
4. The method of any of claims 1 to 3, wherein the layer of niobium-containing metal oxide has a maximum thickness of 4.5 nm or less.
5. The method of any of claims 1 to 4, wherein the niobium-containing metal oxide is selected from a Nb₂O₅ polymorph, NbO₂, Nb₂O₃ or combinations thereof.
6. The method of any of claims 1 to 5, wherein the niobium-containing metal oxide is doped with an element selected from phosphorus, aluminium, copper, chromium, zirconium, vanadium and lithium.
7. The method of any of claims 1 to 4, wherein the niobium-containing metal oxide is selected from a niobium tungsten oxide, a titanium niobium oxide, a niobium molybdenum oxide, a niobium vanadium oxide or combinations thereof.
8. The method of any of claims 1 to 7, wherein the layer of niobium-containing metal oxide is disposed on a particle of the secondary active electrode material.
9. The method of any of claims 1 to 7, wherein the layer of niobium-containing metal oxide is disposed on a film of the secondary active electrode material.
10. The method of any of any preceding claim, wherein the secondary active electrode material is selected from carbon, silicon or a metal oxide.
11. The method of claim 10, wherein the secondary active electrode material is selected from graphite, reduced graphite oxide or hard carbon.
12. The method of claim 10, wherein the secondary active electrode material is selected from lithium titanate, titanium tantalum oxide, tantalum molybdenum oxide and lithium vanadium oxide.
13. The method of any preceding claim, wherein the method is a method of charging and/or discharging an electrochemical cell at a C rate of at least 5C, such as at least 10C, at least 20C, at least 30C, at least 40C at least 50C or at least 60C.

14. The method of any preceding claim, wherein the method comprises a cycle of charging and discharging, or discharging and charging the electrochemical cell.
15. The method of claim 14, wherein the method comprises 2 cycles or more, 5 cycles or more, 10 cycles or more, 50 cycles or more, 100 cycles or more, 500 cycles or more, 1,000 cycles or more, or 2,000 cycles or more.
16. An electrode comprising a surface layer of a niobium-containing metal oxide disposed on a secondary active electrode material.
17. The electrode of claim 16, wherein the electrode is an anode.
18. The electrode of claim 16 or 17, wherein the layer of niobium-containing metal oxide has a maximum thickness of 4.5 nm or less.
19. The electrode of any one of claims 16 to 18, wherein the niobium-containing metal oxide is selected from a Nb_2O_5 polymorph, NbO_2 , Nb_2O_3 or combinations thereof.
20. The electrode of any of claims 16 to 19, wherein the niobium-containing metal oxide is doped with an element selected from phosphorus, aluminium, copper, chromium, zirconium, vanadium and lithium.
21. The electrode of any one of claims 16 to 19, wherein the niobium-containing metal oxide is selected from a niobium tungsten oxide, a titanium niobium oxide, a niobium molybdenum oxide, a niobium vanadium oxide or combinations thereof.
22. The electrode of any of claims 16 to 21, wherein the layer of niobium-containing metal oxide is disposed on a film of the secondary active electrode material.
23. The electrode of any of claims 16 to 21, wherein the layer of niobium-containing metal oxide is disposed on a particle of the secondary active electrode material.
24. The electrode of any of claims 16 to 23, wherein the secondary active electrode material is selected from carbon, silicon or a metal oxide.
25. The electrode of claim 24, wherein the secondary active electrode material is selected from graphite, reduced graphite oxide or hard carbon.
26. The electrode of claim 24, wherein the secondary active electrode material is selected from lithium titanate, titanium tantalum oxide, tantalum molybdenum oxide and lithium vanadium oxide.
27. An electrochemical cell comprising an electrode according to any one of claims 16 to 26.
28. A solid-state battery comprising an electrode according to any one of claims 16 to 26.
29. Use of a working electrode having a surface layer of niobium-containing metal oxide disposed on a secondary active electrode material in an electrochemical cell, wherein the

temperature of the electrochemical cell during charging or discharging is 45 °C or more, such as 50 °C or more, 55 °C or more or 60 °C or more.

30. Use of a working electrode having a surface layer of niobium-containing metal oxide disposed on a secondary active electrode material in an electrochemical cell, wherein the temperature of the electrochemical cell during charging or discharging is 10 °C or less, such as 5 °C or less or 0 °C or less.