CLAIMS

1. A material comprising:

   a transition metal dichalcogenide (TMD), at least one portion of the transition metal dichalcogenide being surface-modified with one or more Group 1 metals and comprising a 1T or 1T' phase, wherein the one or more Group 1 metals comprise Cs and/or Rb.

2. The material of claim 1, wherein the transition metal dichalcogenide comprises one or more of MoS_2, WS_2, $MoSe_2$, WSe_2, $MoTe_2$, alkali metal-doped $MoTe_2$, alkali metal-doped $MoSe_2$, alkali metal-doped MoS_2, alkali metal-doped WSe_2, and alkali metal-doped WS_2.

3. The material of claim 2, wherein the transition metal dichalcogenide comprises one or more of WSe_2 and/or $MoTe_2$.

4. The material of claim 3, wherein the transition metal dichalcogenide comprises WSe_2.

5. The material any one of the preceding claims, the one or more Group 1 metals forming a layer on the surface.

6. The material of any one of the preceding claims, the one or more Group 1 metals forming a layer on the surface of at least first and second portions of the

transition metal dichalcogenide, the first and second portions each comprising a 1T or 1T' phase.

7. The material of claim 6, wherein the transition metal dichalcogenide further comprises a third portion arranged between the first and second portions and which is not surface modified with one or more Group 1 metals.

8. The material of claim 7, wherein the first and second portions are in a different structural phase to the third portion.

9. The material of any one of claims 6 to 8, wherein the first and second portions comprise different first and second edge portions of the TMD, respectively.

10. The material of either of claims 7 or 8, wherein the layer of one or more Group 1 metals has a thickness of greater than or equal to 0.2nm.

11. The material of any one of the preceding claims, wherein the layer of one or more Group 1 metals has a thickness of between 0.4nm and 2.0nm.

12. The material of any one of the preceding claims, wherein at least a portion of the transition metal dichalcogenide has a thickness of between 1 and 5 layers.

13. The material of claim 12, wherein at least a portion of the transition metal dichalcogenide is a mono-layer or a bi-layer.

14. An electronic device comprising:

the material of any one of claims 7 to 13; and

first and second electrodes,

wherein the first and second electrodes are in direct electrical contact with the first and second portions of the transition metal dichalcogenide, respectively.

15. The electronic device of claim 14, wherein the device exhibits substantially Ohmic contact behaviour with respect to the first and second electrodes.

16. The electronic device of either claim 14 or 15 having a Schottky barrier height of less than or equal to 10meV.

17. The electronic device of any one of claims 14 to 16, wherein the electronic device comprises a field-effect transistor.

18. The electronic device of any one of claims 14 to 16, wherein the electronic device comprises a logic inverter.

19. A method of producing the material of any one of claims 1 to 13, the method comprising:

providing an initial transition metal dichalcogenide comprising a 2H phase; and evaporating the one or more Group 1 metals onto at least a portion of the initial transition metal dichalcogenide to surface-modify the at least one portion of the initial transition metal dichalcogenide and induce a phase transition to the 1T or 1T' phase.

20. A method of producing an electronic device comprising: a material comprising a transition metal dichalcogenide (TMD), at least first and second portions of the transition metal dichalcogenide being surface-modified with one or more Group 1 metals, wherein the one or more Group 1 metals comprise Cs and/or Rb, the one or more Group 1 metals forming a layer on the surface of at least the first and second portions of the transition metal dichalcogenide and a third portion which is not surface modified with one or more Group 1 metals; and first and second electrodes, wherein the first and second electrodes are in direct electrical contact with the first and second portions of the transition metal dichalcogenide, respectively, the method comprising:

providing a layer of the transition metal dichalcogenide and the first and second electrodes on a surface of a substrate, such that the first and second electrodes are in electrical contact with the layer of the transition metal dichalcogenide;

evaporating the one or more Group 1 metals onto the surface of the first and second portions of the layer of transition metal dichalcogenide such that the one or more Group 1 metals has a thickness of at least 0.2nm, wherein the first and second portions of the layer of transition metal dichalcogenide are adjacent to the first and second electrodes respectively.