

CLAIMS

1. A material comprising: a transition metal dichalcogenide (TMD) comprising a surface, a least a portion of the surface being surface-modified with one or more Group 1 metals, wherein the one or more Group 1 metals comprise Cs
5 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 ,
10 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 .
- 15 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.
- 5 7. The material of claim 6, wherein the transition metal dichalcogenide further comprises a third portion 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
10 phase than the third portion.
9. 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.
- 15 10. The material of claim 9, wherein the layer of one or more Group 1 metals has a thickness of between 0.4nm and 2.0nm.
11. 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.
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12. The material of claim 11, wherein at least a portion of the transition metal dichalcogenide is a mono-layer or a bi-layer.

13. An electronic device comprising the material of any one of claims 7 to 12; and
first and second electrodes,
wherein the first and second electrodes are in direct electrical contact with the
5 first and second portions of the transition metal dichalcogenide, respectively.
14. The electronic device of claim 13, wherein the device exhibits substantially
Ohmic contact behaviour with respect to the first and second electrodes.
- 10 15. The electronic device of either claim 13 or 14 having a Schottky barrier height
of less than or equal to 10meV.
16. The electronic device of any one of claims 13 to 15, wherein the electronic
device is a field-effect transistor.
- 15 17. The electronic device of any one of claims 13 to 15, wherein the electronic
device is a logic inverter.
18. A method of producing the material of any one of claims 1 to 12, the method
20 comprising:

providing a transition metal dichalcogenide; and

evaporating one or more Group 1 metals onto at least a portion of a surface of the transition metal dichalcogenide, wherein the one or more group 1 metals comprises Cs and/or Rb.

5 19. A method of producing the electronic device of any one of claims 13 to 17, the method comprising:

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

evaporating one or more Group 1 metals onto a surface of 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
15 the first and second electrodes respectively, and wherein the one or more Group 1 metals comprise Cs and/or Rb.

20. The method of claim 19, wherein evaporating a Group 1 metal onto a surface of first and second portions of the layer of transition metal dichalcogenide
20 comprises forming a barrier layer on portions of the surface of all but the first

and second portions of the transition metal dichalcogenide prior to evaporating the one or more Group 1 metals.