CLAIMS

We claim:

1. A catalyst consisting essentially of IrO_xH_y, wherein X and Y fulfill an equation $4 + Y = 2X$.

2. The catalyst of claim 1, wherein the catalyst consists of IrO_xH_y.

3. The catalyst of claim 1 or 2, wherein $3.70 < X < 3.90$, and $3.40 < Y < 3.80$.

4. The catalyst of any one of claims 1 to 3, wherein:

(a) the catalyst is amorphous; and/or

(b) the catalyst comprises mesopores, micropores and/or macropores.

5. The catalyst of any one of claims 1 to 4, wherein the catalyst is support-free.

6. The catalyst of any one of claims 1 to 5, wherein the catalyst has a BET surface area of about 35 m^2/g to about 45 m^2/g.

7. The catalyst of any one of claims 1 to 6, wherein:

(a) the oxidation state of Ir is 4+; and/or

(b) the mass of Ir is about 70 wt% to about 80 wt% based on the total weight of the catalyst.

8. The catalyst of any one of claims 1 to 7, wherein X is 3.76 and Y is 3.52.

9. The catalyst of any one of claims 1 to 8, wherein the catalyst is $IrO_2 \bullet 1.76H_2O$.

10. A method of preparing a catalyst consisting essentially of IrO_xH_y, wherein X and Y fulfill an equation $4 + Y = 2X$, the method comprising:

(i) immersing Sr_4IrO_6 in acid to form a mixture; and
(ii) subjecting the mixture of step (i) to agitation for more than 12 hours.

11. The method of claim 10, wherein:

(a) step (ii) is repeated at least once; and/or

(b) the mixture of step (i) is subjected to agitation for about 12 hours to about 36 hours.

12. The method of claim 10 or 11, further comprising:

(iii) subjecting the mixture of step (ii) to centrifugation to obtain a powder; and
(iv) ball milling the powder of step (iii).

13. The method of any one of claims 10 to 12, wherein:

(a) the mixture of step (i) is subjected to agitation for about 24 hours;

(b) the acid is selected from the group consisting of perchloric acid and nitric acid; and/or

(c) the Sr_4IrO_6 is obtained by mixing $SrCO_3$ and IrO_2, and calcining the mixed $SrCO_3$ and IrO_2 at a temperature at or above 1000 °C.

14. A catalyst obtained by the method of any one of claims 10 to 13.

15. Use of the catalyst of any one of claims 1 to 9 or 14 to produce hydrogen.