CLAIMS

1. A ruthenium-based electrocatalyst comprising:

ruthenium oxychloride species having a general formula $RuOCl_y$ dispersed in a manganese oxide support having a general formula MnO_x.

2. The ruthenium-based electrocatalyst according to claim 1, wherein y represents a number ranging from 0 to 0.4, and x represents a number 1.7 to 1.8.

3. The ruthenium-based electrocatalyst according to claim 2, wherein y represents a number ranging from 0.2 to 0.4.

4. The ruthenium-based electrocatalyst according to claim 1, wherein the ruthenium oxychloride species are chemically bonded to the manganese oxide support.

5. The ruthenium-based electrocatalyst according to claim 2 or 3, wherein the ruthenium-based electrocatalyst is $RuOCl@MnO_x$.

6. The ruthenium-based electrocatalyst according to claim 1, wherein the molar ratio of $RuOCl_y$ to MnO_x is 1:11.1 or 1:7.8.

7. The ruthenium-based electrocatalyst according to claim 1, wherein the Ru:Cl:O ratio in RuOCl is 1:0.4:2.4 or 1:0.2:2.1.

8. The ruthenium-based electrocatalyst according to claim 1, wherein the Mn:O ratio in MnO_x is 1:1.7 or 1:1.8.

9. The ruthenium-based electrocatalyst according to any one of claims 1 to 8, further comprising a substrate, wherein the ruthenium oxychloride species and the manganese oxide support are dispersed within the substrate.

10. A method of preparing a ruthenium-based electrocatalyst, the method comprising:

heating a substate;

adding a precursor solution containing a chloride salt of ruthenium and a nitrate salt of manganese onto the substrate; and

heating the precursor solution with the substrate to obtain a ruthenium-based electrocatalyst comprising ruthenium oxychloride species having a general formula $RuOCl_y$ dispersed in a manganese oxide support having a general formula MnO_x.

11. The method according to claim 10, wherein the precursor solution and the substrate are heated at a temperature of 210°C.

12. The method according to any one of claim 10 or 11, wherein y represents a number ranging from 0 to 0.4, and x represents a number 1.7 to 1.8.

13. The method according to claim 12, wherein y represents a number ranging from 0.2 to 0.4.

14. The method according to claim 10, wherein the ruthenium oxychloride species and the manganese oxide support are dispersed within the substrate.

15. A membrane electrode for use in a proton-exchange membrane electrolyzer comprising:

a substrate, and ruthenium oxychloride species having a general formula $RuOCl_y$ dispersed in a manganese oxide support having a general formula MnO_x, wherein the ruthenium oxychloride species and the manganese oxide support are dispersed within the substrate.

16. The membrane electrode according to claim 15, wherein y represents a number ranging from 0 to 0.4, and x represents a number 1.7 to 1.8.

17. The membrane electrode according to claim 16, wherein y represents a number ranging from 0.2 to 0.4.