

Accordingly, gas separation assemblies are provided that can include a plurality of individual cells housing metal organic framework. The plurality can be configured as at least one series of cells and another series of cells. Each of the series can include at least two electrically isolated individual cells. The assembly can include a channel, such as the channel of electrolyte **86** between the one series of cells and the other series of cells. In accordance with example implementations, the one series can be aligned laterally of the other series, and the individual cells of the one series are aligned lateral to the individual cells of the other series to form a pair of cells, for example. With regard to the pairs of cells, one of the pair of cells can be configured to dissociate guest materials, and the other of the pair of cells can be configured to associate guest materials. The assembly can include conduits extending along the perimeter of each of the series of cells, with the conduits configured to expose the metal organic framework of each of the cells of each of the series. One series of cells can be in fluid communication with one conduit, and the other series of cells can be in fluid communication with another conduit.

In compliance with the statute, embodiments of the invention have been described in language more or less specific as to structural and methodical features. It is to be understood, however, that the entire invention is not limited to the specific features and/or embodiments shown and/or described, since the disclosed embodiments comprise forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims appropriately interpreted in accordance with the doctrine of equivalents.

The invention claimed is:

1. A method for releasing associated guest materials from a metal organic framework the method comprising altering the oxidation state of at least a portion of the metal of the metal organic framework to dissociate at least a portion of the guest materials from the framework.

2. The method of claim **1** wherein the portion of the metal of the metal organic framework is a transition metal.

3. The method of claim **1** wherein the portion of the metal of the metal organic framework is one or more of Ti, Zr, Hf, Rf, V, Nb, Ta, Db, Cr, Mo, W, Sg, Mn, Tc, Re, Bh, Fe, Ru, Os, Hs, Co, Rh, Os, Hs, Co, Rh, Ir, Mt, Ni, pd, Pt, Ds, Cu, Ag, Au, and Rg.

4. The method of claim **1** wherein the portion of the metal of the metal organic framework has a mixed oxidation state.

5. The method of claim **1** wherein the portion of the metal of the metal organic framework is represented as (M^{2+}/M^{3+}) .

6. The method of claim **1** wherein the portion of the metal of the metal organic framework is coupled to a substantially conductive organic ligand.

7. The method of claim **1** wherein the guest material comprises carbon dioxide.

8. A method for associating guest materials with a metal organic framework, the method comprising altering the oxidation state of at least a portion of the metal of the metal organic framework to associate at least a portion of the guest materials with the framework.

9. The method of claim **8** further comprising exposing a mixture to the metal organic framework, the mixture comprising the guest materials and other materials, at least a portion of the other materials not being associated with the metal organic framework upon the exposing.

10. The method of claim **9** wherein the mixture comprises a flue gas.

11. The method of claim **9** wherein the mixture comprises combustion products.

12. The method of claim **9** wherein the mixture comprises carbon dioxide and water.

13. The method of claim **9** wherein the mixture comprises carbon dioxide and water and the guest material is carbon dioxide.

14. A method for selectively associating or dissociating guest materials with a metal organic framework, the method comprising altering the oxidation state of at least a portion of the metal of the metal organic framework to associate or dissociate at least a portion of the guest materials with the framework.

15. The method of claim **14** further comprising exposing a mixture to the metal organic framework, the mixture comprising the guest materials and other materials, at least a portion of the other materials not being associated with the metal organic framework upon the exposing.

16. The method of claim **15** wherein during the exposing, guest material is associated with the metal organic framework.

17. The method of claim **16** further comprising: ceasing the exposing;

altering the oxidation state of the portion of the metal; and dissociating at least a portion of the guest materials from the metal organic framework.

18. The method of claim **17** further comprising:

after the dissociating, altering the oxidation state of the portion of the metal to return the oxidation state to an associating oxidation state;

after the altering, exposing the mixture to the metal organic framework; and

associating at least a portion of the guest material of the mixture with the metal organic framework.

19. The method of claim **14** wherein the altering comprises applying a predetermined voltage to the metal organic framework.

20. The method of claim **14** wherein the oxidation state of the portion of the metal is electrochemically altered.

21. A system for associating or dissociating guest materials within a series of metal organic frameworks, the system comprising at least two individual metal organic frameworks, one of the individual metal organic frameworks configured to dissociate and the other configured to associate guest materials, wherein the one framework comprises at least some metals of one oxidation state and the other framework comprises the same metals of another oxidation state.

22. The system of claim **21** further comprising:

a power source; and

a controller operatively coupled to both the power source and the metal organic frameworks.

23. The system of claim **21** wherein the metal of the metal organic frameworks are mixed valence transition metals.

24. The system of claim **22** wherein the one metal organic framework comprises (M^{2+}/M^{3+}) , and the other metal organic framework comprises (M_{3+}/M^{3+}) .

25. The system of claim **21** further comprising a conduit extending to a valve in fluid communication with both the metal organic frameworks.

26. The system of claim **25** further comprising:

a power source;

a motor configured to operate the valve; and

a controller operatively coupled to the power source, the metal organic frameworks, and the motor.

27. A gas separation assembly comprising:

a plurality of individual cells housing metal organic framework, the plurality comprising at least one series of cells and another series of cells, each series comprising at least two electrically isolated individual cells;