METHODS FOR ASSOCIATING OR DISSOCIATING GUEST MATERIALS WITH A METAL ORGANIC FRAMEWORK, SYSTEMS FOR ASSOCIATING OR DISSOCIATING GUEST MATERIALS WITHIN A SERIES OF METAL ORGANIC FRAMEWORKS, THERMAL ENERGY TRANSFER ASSEMBLIES, AND METHODS FOR TRANSFERRING THERMAL ENERGY

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. Provisional Patent Application No. 61/448,965 which was filed on Mar. 3, 2011, entitled "Methods for Associating or Dissociating Guest Materials with a Metal Organic Framework, Systems for Associating or Dissociating Guest Materials Within a Series of Metal Organic Frameworks, Thermal Energy Transfer Assemblies, and Methods for Transferring Thermal Energy", the entirety of which is incorporated by reference herein.

STATEMENT AS TO RIGHTS TO INVENTIONS MADE UNDER FEDERALLY-SPONSORED RESEARCH AND DEVELOPMENT

This invention was made with Government support under Contract DE-AC0576RLO1830 awarded by the U.S. Department of Energy. The Government has certain rights in the invention.

TECHNICAL FIELD

The present disclosure relates to the use of metal organic frameworks.

BACKGROUND

Recently, metal organic frameworks have been proposed for use in various capacities. These capacities include but are not limited to the separation of molecules or materials from mixtures that include the molecules or materials. As an example, in various applications, metal organic frameworks have been proposed for use as materials that can be used to separate carbon dioxide from methane, for example.

In accordance with other applications, metal organic frameworks have also been utilized to retain certain molecules in higher density than they would be retained at when super pressurized. As an example, metal organic frameworks have been proposed for use as hydrogen storage tanks.

In these applications, in the past, the metal organic frameworks have been configured to selectively adsorb or desorb or associate or dissociate certain materials. As an example, the temperature and/or pressure of the metal organic framework can be manipulated, as well as the chemical and/or geometric structure of the metal organic framework, to facilitate either the association or adsorption, or the dissociation or desorption of the specific materials.

The present disclosure provides methods for using metal organic frameworks as well as systems that include metal organic frameworks and assemblies that include metal organic frameworks.

SUMMARY

Methods for releasing associated guest materials from a metal organic framework are provided with example methods including 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. Example methods for associating guest materials with a metal organic framework are also provided with example methods including 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.

Methods are provided for selectively associating or dissociating guest materials with a metal organic framework. Example methods can include 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.

Systems for associating or dissociating guest materials within a series of metal organic frameworks are provided. Example systems can include at least two individual metal organic frameworks, with one of the individual metal organic frameworks configured to dissociate guest materials, and the other configured to associate guest materials. One framework can include at least some metals of one oxidation state and the other framework can include the same metals of another oxidation state.

Thermal energy transfer assemblies are provided. Example assemblies can include a metal organic framework electrically coupled to a power source; and a heat transfer assembly associated with the metal organic framework.

Methods for transferring thermal energy are also provided. Example methods can include adsorbing or desorbing guest materials to or from a metal organic framework, the adsorbing or desorbing facilitated by changing an oxidation state of at least some of the metal within the metal organic framework. The methods can also include providing thermal communication between a fluid and one or both of the metal organic framework or the guest materials, with the fluid changing temperature upon communication with the one or both of the metal organic framework or the guest materials.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the disclosure are described below with reference to the following accompanying drawings.

FIG. **1** is a configuration of a metal organic framework according to an embodiment of the disclosure.

FIG. **2** represents configurations of metal organic frameworks according to an embodiment of the disclosure.

FIG. **3** represents configurations of metal organic framework and mixtures that include guest materials depicted according to an embodiment of the disclosure.

FIG. **4** represents a system including metal organic framework according to an embodiment of the disclosure.

FIG. **5** represents a system including metal organic framework according to an embodiment of the disclosure.

DESCRIPTION

This disclosure is submitted in furtherance of the constitutional purposes of the U.S. Patent Laws "to promote the progress of science and useful arts" (Article 1, Section 8).

The methods, systems, and assemblies of the present disclosure will be described with reference to FIGS. **1-5**. Referring first to FIG. **1**, a metal organic framework configuration **10** is shown that includes metal organic framework **12** conductively coupled via contact **16** and conductive conduit **18** to power source **20**. Framework **12** can include metals coupled to organic components. Framework **12** may be configured to define open sites designed to receive guest materials. The