What is claimed is:

1. A humidity management system comprising:

an air stream inlet;

a first regenerable nanostructured desiccant porous material configured to adsorb water from an air stream at a first pressure and to release water when subjected to a second pressure, wherein the second pressure is lower than the first pressure, wherein the first regenerable nanostructured desiccant porous material is positioned in a first conduit;

a second regenerable nanostructured desiccant porous material configured to adsorb water from an air stream at a first pressure and to release water when subjected to a second pressure, wherein the second pressure is lower than the first pressure, wherein the second regenerable nanostructured desiccant porous material is positioned in a second conduit;

wherein the first conduit and the second conduit are arranged separate from each other;

a vacuum source that alternately communicates with the first regenerable nanostructured desiccant porous material or the second regenerable nanostructured desiccant porous material; and

at least one heat transfer pipe thermally coupled to the first regenerable nanostructured desiccant porous material and the second regenerable nanostructured desiccant porous material.

2. The humidity management system of claim 1, further comprising an air flow diverter positioned upstream of the first regenerable nanostructured desiccant porous material and the second regenerable nanostructured desiccant porous material.

3. The humidity management system of claim 1, further comprising a condenser positioned downstream of and in communication with the first regenerable nanostructured desiccant porous material and the second regenerable nanostructured desiccant porous material, and wherein the condenser is in communication with the vacuum source.

4. The humidity management system of claim 3, further comprising a water pump in communication with the condenser.

5. The humidity management system of claim 1, wherein the first regenerable nanostructured desiccant porous material and the second regenerable nanostructured desiccant porous material each comprise a metal organic framework material.

6. The humidity management system of claim 1, wherein the first conduit and the second conduit are arranged parallel to each other.

7. A method comprising:

operating the system of claim 1 in (A) adsorption mode to remove water from an air stream (B) regeneration mode to release adsorbed water,

wherein the adsorption mode comprises contacting the air stream with the first regenerable nanostructured desiccant porous material at a first pressure to adsorb water from the air stream and transferring heat from the first regenerable nanostructured porous material to the second regenerable nanostructured porous material while the first regenerable nanostructured porous material is under the first pressure; and

the regeneration mode comprises releasing water adsorbed by the first regenerable nanostructured desiccant porous material at a second pressure, wherein the second pressure is lower than the first pressure, and transferring heat to the first regenerable nanostructured porous material from the second regenerable

nanostructured porous material while first regenerable nanostructured porous material is under the second pressure.

8. The method of claim 7, comprising operating the apparatus such that the first regenerable nanostructured desiccant porous material operates in adsorption mode when the second regenerable nanostructured porous material operates in regeneration mode, and the second regenerable nanostructured porous material operates in adsorption mode when the first regenerable nanostructured porous material operates in regeneration mode.