PATENT DOCUMENT

[0004]

Patent Document 1: Japanese Unexamined Patent Publication No. 2009-019863

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0005]

In the adsorption heat exchanger, adsorption performance may deteriorate, especially when the adsorption layer deteriorates in a short period of time.

[0006]

Embodiments of the present disclosure substantially prevent deterioration of the adsorption layer in the adsorption heat exchanger.

SOLUTION TO THE PROBLEM

[0007]

According to a first aspect of the present disclosure, there is provided an adsorption heat exchanger including: a base sheet; and an adsorbent supported on the base sheet by using a binder, wherein the adsorbent desorbs and absorbs moisture with respect to air. The adsorption heat exchanger satisfies a first condition in which amounts of the binder and the adsorbent supported after immersing the base sheet with the adsorbent in 10% aqueous nitric acid solution for 40 hours at an environment temperature of 70°C are 32% to 100% of amounts of the binder and the adsorbent supported before the immersion.

[0008]

In the above aspect, the adsorption heat exchanger is configured to satisfy a first

condition. Thus, aging deterioration can be kept within a desirable range when the adsorption heat exchanger is practically used.

[0009]

According to a second aspect of the present disclosure, there is provided an adsorption heat exchanger including: a base sheet; and an adsorbent supported on the base sheet by using a binder, wherein the adsorbent desorbs and absorbs moisture with respect to air, and the adsorption heat exchanger satisfies a second condition in which amounts of the binder and the adsorbent supported after alternately exposing to a dry state at an environment temperature of 70°C and a humidity of 20% and a wet state with water spraying over the adsorption heat exchanger, a total of 5000 times are 90% to 100% of amounts of the binder and the adsorbent before the exposure

[0010]

In the above aspect, the adsorption heat exchanger satisfies a second condition. Thus, aging deterioration can be kept within a desirable range when the adsorption heat exchanger is practically used.

[0011]

[0012]

[0013]

[0014]

[0015]

In an embodiment of the above aspect, an overall thickness of the binder and the adsorbent is in a range from 20 μm to 120 μm.

[0016]

In an embodiment of the above aspect, the binder includes at least one of a fluorine resin, an acrylic resin, an epoxy resin, or an urethane resin, the adsorbent is supported using the binder and a crosslinking agent, and the crosslinking agent is a hydrocarbon having at least one of a carbodiimide group, an isocyanate group, or an ester group.

[0017]

In the above embodiment, the adsorption heat exchanger can be realized by using specific materials described above as the respective components.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a piping system diagram illustrating a configuration of a refrigerant circuit in a humidity control apparatus. In FIG. 1, an illustration (A) illustrates an operation during a first operation, and an illustration (B) illustrates an operation during a second operation.

FIG. 2 is a schematic perspective view of an adsorption heat exchanger.

FIG. 3 is a side view of a heat exchanger unit constituting the adsorption heat exchanger.

FIG. 4 is a sectional view taken along line A-A in FIG. 3.

FIG. 5 schematically illustrates a binder and an adsorbent provided on a base sheet.

FIG. 6 illustrates an example where a coating layer is provided on the base sheet in

CLAIMS

1. An adsorption heat exchanger comprising:

a base sheet; and

an adsorbent supported on the base sheet by using a binder, wherein

the adsorbent desorbs and absorbs moisture with respect to air, and

the adsorption heat exchanger satisfies a first condition in which amounts of the binder and the adsorbent supported after immersing the base sheet with the adsorbent in 10% aqueous nitric acid solution for 40 hours at an environment temperature of 70°C are 32% to 100% of amounts of the binder and the adsorbent supported before the immersion.

2. An adsorption heat exchanger comprising:

a base sheet; and

an adsorbent supported on the base sheet by using a binder, wherein

the adsorbent desorbs and absorbs moisture with respect to air, and

the adsorption heat exchanger satisfies a second condition in which amounts of the binder and the adsorbent supported after alternately exposing to a dry state at an environment temperature of 70°C and a humidity of 20% and a wet state with water spraying over the adsorption heat exchanger, a total of 5000 times are 90% to 100% of amounts of the binder and the adsorbent before the exposure.

3. The adsorption heat exchanger of claim 1 or 2, wherein

an overall thickness of the binder and the adsorbent is in a range from 20 μm to 120 μm.

4. The adsorption heat exchanger of any one of claims 1 to 3, wherein

the binder includes at least one of a fluorine resin, an acrylic resin, an epoxy resin, or an urethane resin,

the adsorbent is supported using the binder and a crosslinking agent, and

the crosslinking agent is a hydrocarbon having at least one of a carbodiimide group, an isocyanate group, or an ester group.