A heat-conducting structure comprises a heat-conducting metal layer, a heat-conducting support layer, and a heat-conducting protection layer. The heat-conducting support layer is formed to enclose the heat-conducting metal layer thereby preventing the heat-conducting metal layer from thermal deformation, while the heat-conducting protection layer is formed to enclose the heat-conducting support layer. In another embodiment, the heat-conducting structures are utilized to form a heat exchanger or a heat-exchanging system comprising a heat-absorbing zone and a heat-dissipating zone, whereby a high-temperature fluid is guided to flow through the heat-absorbing zone for transmitting the heat to the heat-conducting structures within the heat-absorbing zone through heat convection and the heat-exchanging structures conducting the heat to the heat-dissipating zone such that a low-temperature fluid passing therethrough can absorb the heat dissipated from the heat-exchanging structures within the heat-dissipating zone and transmit the heat energy out of the heat exchanger or the heat-exchanging system.
HEAT-CONDUCTING STRUCTURE AND HEAT EXCHANGER AND HEAT-EXCHANGING SYSTEM USING THEREOF

FIELD OF THE INVENTION

[0001] The present invention is related to a heat-exchanging technology, and, more particularly, to a heat-conducting structure having a heat-conducting metal layer, a heat-conducting support layer, and a heat-conducting protection layer, and a heat exchanger and a heat-exchanging system using the heat-conducting structure.

BACKGROUND OF THE INVENTION

[0002] Generally speaking, the heat exchanger is operated to absorb heat contained within the high-temperature fluid, and, subsequently, transfer absorbed heat to another low-temperature fluid through principle that heat energy is transferred from a high temperature region to low temperature region due to the random molecular motion. The low-temperature fluid absorbs heat and is transmitted to a heat-required area through a circulation pipelines. The heat exchanger plays a vital role for the development of the modern industry, and, consequently, it can be applied in different fields such as fossil-fuel power plant, nuclear power plant, or incineration for waste treatment.

[0003] One major application of the heat exchanger is to be utilized in heat-recovery industrial field, wherein in refuse incineration plant or fossil-fuel power plant, for example, high-temperature waste gas with high heat capacity was generated during the treatment or reaction process, and the waste gas will be treated by a purification process, thereby forming a clean gas and, subsequently, discharging the clean gas to the atmosphere. During the purification process, in addition to filtering out the dust particles or contaminants inside the waste gas to form the clean gas, the clean gas with high temperature and heat capacity will also be conducted into the heat exchanger for heat energy recovery. The recovered heat energy is further utilized to preheat the granular material or peripheral device for filtering waste gas whereby not only can the filtration efficiency be enhanced, the energy requirement for preheating can also be saved. In power plant, after the cooling water, utilized to cool power reactor, absorbed the heat of reactor, the cooling water is then conducted into the exchanger thereby recovering the heat inside the cooling water.

[0004] However, in conventional technology, the heat-conducting material for making the heat exchanger, in addition to conducting heat energy, should also have characteristics of anticorrosion and high-temperature resistance. Conventionally, the heat-conducting material is made from a material having high-percentage of Inconel® alloy. Inconel® alloy has widely varying compositions, but all are predominantly nickel, with iron and chromium as the second elements. However, since the nickel is included with a higher percentage for forming the Inconel® alloy, the cost for making such material is expensive. Besides, although Inconel® alloys are oxidation-resistance and anticorrosion materials due to bonding interaction between the metal components inside the Inconel® alloys, which is suitable for application in extreme environments subjected to high temperature, the heat conducting efficiency is insufficient due to the poor thermal conductivity.

SUMMARY OF THE INVENTION

[0005] The present invention provides a heat-conducting structure, formed by three metal layers including a heat-conducting metal layer, a heat-conducting support layer, and a heat-conducting protection layer. The heat-conducting structure has capability of anticorrosion, high-temperature resistance, and high thermal conductivity so that the heat-conducting structure can be utilized in heat exchanger or heat exchanging system in different types of industrial fields.

[0006] The present invention provides a heat exchanger and heat exchanging system, which are respectively formed by three metal layers for exchanging heat, whereby the heat exchange efficiency and heat conducting efficiency can be both enhanced and further the cost of production can also be saved due to less use of expensive nickel material.

[0007] In one exemplary embodiment, the present invention provides a heat-conducting structure, comprising: a heat-conducting metal layer; a heat-conducting support layer, formed to clad and support a surface of the heat-conducting metal layer thereby preventing the heat-conducting metal layer from thermal deformation; and a heat-conducting protection layer, formed to clad a surface of the heat-conducting support layer.

[0008] In another exemplary embodiment, the present invention further provides a heat exchanger, comprising: a plurality of heat-conducting structures, arranged spatially apart from each other, wherein a heat-conducting space is formed between two adjacent heat-conducting structures; a supporting part, arranged on the plurality of heat-conducting structures for dividing the plurality of heat-conducting structures into a heat-absorbing zone and a heat-dissipating zone; each heat-conducting structures within the heat-absorbing zone further comprising: a first heat-conducting metal layer; a first heat-conducting support layer, formed to clad and support a surface of the first heat-conducting metal layer thereby preventing the first heat-conducting metal layer from thermal deformation; and a first heat-conducting protection layer, formed to clad a surface of the first heat-conducting support layer.

[0009] In a further exemplary embodiment, the present invention further provides a heat-exchanging system, comprising: a heat exchanger, further comprising: a plurality of heat-conducting structures, arranged spatially apart from each other, wherein a heat-conducting space is formed between two adjacent heat-conducting structures; and a supporting part, arranged on the plurality of heat-conducting structures for dividing the plurality of heat-conducting structures into a heat-absorbing zone and a heat-dissipating zone, wherein each heat-conducting structures within the heat-absorbing zone further comprising: a first heat-conducting metal layer; a first heat-conducting support layer, formed to clad and support a surface of the first heat-conducting metal layer thereby preventing the first heat-conducting metal layer from thermal deformation; and a first heat-conducting protection layer, formed to clad a surface of the first heat-conducting support layer; and a heat generator, providing a first fluid to pass through the heat-absorbing zone such that the heat-conducting structure in the heat-absorbing zone absorbs heat from the first fluid, and conducts the absorbed heat to the heat-dissipating zone; and a heat storage device, coupled to the heat-dissipating zone of the heat exchanger, the heat storage device further receiving a second fluid passing through the heat-dissipating zone and absorbing the heat from the heat-conducting structure within the heat-dissipating zone.
The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein:

FIG. 1 illustrates a heat exchanger according to an embodiment of the present invention;

FIG. 2A illustrates a heat-conducting structure according to an embodiment of the present invention;

FIG. 2B illustrates a cross-sectional view associated with the heat-conducting structure according to an embodiment of the present invention;

FIGS. 2C and 2D illustrates another embodiments of the heat-conducting structures according to the present invention.

FIGS. 3A and 3B respectively illustrate alternative types of heat-conducting structure according to the present invention.

FIGS. 4A and 4B respectively illustrate alternative embodiments of heat exchanger and heat-conducting structure according to the present invention.

FIG. 5A illustrates an alternative embodiment of the heat exchanger according to the present invention;

FIG. 5B illustrates a cross-sectional view of the column-shaped structure;

FIG. 6 illustrates a heat-exchanging system according to an embodiment of the present invention.

For your esteemed members of reviewing committe to further understand and recognize the fulfilled functions and structural characteristics of the invention, several exemplary embodiments cooperating with detailed description are presented as the follows.

Please refer to FIG. 1, which illustrates a heat exchanger according to an embodiment of the present invention. The heat exchanger comprises a plurality of heat-conducting structures, and a supporting part. The plurality of heat-conducting structures are arranged spatially apart from each other such that a heat-conducting space is formed between two adjacent heat-conducting structures.

In the present embodiment, each heat-conducting structure is formed in a plate-shaped structure.

Please refer to FIG. 2A, which illustrates the heat-conducting structure according to an embodiment of the present invention. The heat-conducting structure is a multiple-layered structure comprising a heat-conducting metal layer, a heat-conducting support layer, and a heat-conducting protection layer. The heat-conducting support layer is formed to clad a surface of the heat-conducting metal layer for supporting the heat-conducting metal layer so as to prevent the heat-conducting metal layer from thermal deformation. The heat-conducting protection layer is formed to clad a surface of the heat-conducting support layer, wherein the heat-conducting protection layer is selective to a material having a thermal conductivity in a range of 100 W/(m·K) to 400 W/(m·K), wherein the material can be, but should not be limited to, a copper, a silver, a gold, an aluminum, or an alloy combining the at least two kinds of aforementioned exemplary metals. The heat-conducting support layer can be selective to a material having a thermal conductivity in a range of 9 W/(m·K) to 26 W/(m·K), wherein the material can be, but should not be limited to, a ferro-alloy, such as stainless steel, or carbon steel. The heat-conducting protection layer can be selective to a material having a thermal conductivity in a range of 8 W/(m·K) to 72 W/(m·K), wherein the material can be, but should not be limited to, a nickel or nickel alloy.

In the present embodiment, the material of heat-conducting metal layer is copper, the material of the heat-conducting support layer is stainless steel, and the material of the heat-conducting protection layer is nickel.

In the present embodiment, the copper has superior thermal conductivity of about, for example, 352 W/(m·K) at absolute temperature 1000K, the stainless steel has thermal conductivity of about 24.2 W/(m·K) at room temperature, and the nickel has thermal conductivity of about 71.8 W/(m·K) at absolute temperature 1000K. Since the heat-conducting structure of the present invention is a multiple-layered metal structure, the thermal conductivity of the multiple-layered metal structure can be greatly improved, in which the heat-conducting metal layer is utilized to conduct heat, the heat-conducting support layer is utilized to support the heat-conducting metal layer thereby preventing the heat-conducting metal layer from thermal deformation in the high-temperature working environment, and, selectively, the outer surface of the heat-conducting support layer can be wrapped by alternative kinds of heat-conducting protection layer according to a need condition, such as temperature requirement, and anticorrosion requirement of the working environment, that the heat-conducting structure of the present invention can be broadly applied in different types of heat-exchanging fields.

Please refer to FIG. 2B, which illustrates a cross-sectional view associated with the heat-conducting structure according to an embodiment of the present invention. In the present embodiment, a top surface and bottom surface of the heat-conducting metal layer are respectively covered by the heat-conducting support layer, while the top surface of the heat-conducting support layer covering the top surface of the heat-conducting metal layer, the bottom surface of the heat-conducting support layer covering the bottom surface of the heat-conducting metal layer, and lateral surfaces of the heat-conducting metal layer and heat-conducting support layer are covered by the heat-conducting protection layer.

In the embodiment of the present heat-conducting structure, since the outer surface of the heat-conducting metal layer is covered with the heat-conducting support layer, even though the nickel is less used, the efficiency of the thermal conductivity can be effectively maintained while the cost for producing the heat-conducting structure can be reduced as well. Please refer to FIG. 1, the supporting part is arranged on the plurality of heat-conducting structures for dividing the plurality of heat-conducting structures into a heat-absorbing zone, being capable of allowing a high-temperature fluid flowing therethrough and a heat-dissipating zone, being capable of allowing a low-temperature fluid flowing therethrough. It is noted that the material for making the support part can be a heat-insulating material or a heat-conducting material.
which depends on the need of the utilization. In the present embodiment, the high-temperature fluid 90 could be a corrosive fluid.

[0026] It is noted that the heat exchanger 2 is accommodated within a housing 3 having isolating structure for isolating the low-temperature fluid 91 and high-temperature fluid 90. The housing 3 for isolating the low-temperature fluid 91 and high-temperature fluid 90 is related to an art that are well-known by the one having ordinary skill in the art; therefore, it would not be further described in detail hereinafter. The aforesaid fluid 90 and 91 can be a gas, a liquid or a slurry, a mixture of solid and liquid substances, wherein the fluid 90 and 91 are both gas in the present embodiment. When the high-temperature fluid 90 enters the heat-absorbing zone 23 and flows through the heat-conducting space 22 formed between two adjacent heat-conducting structures 20, the heat contained in the high-temperature fluid 90 will be transmitted to the heat-conducting structure 20 in the heat-absorbing zone 23 by heat convention due to the temperature differences therebetween.

[0027] After the heat-conducting structure 20 absorbs the heat from the high-temperature fluid 90, the heat inside the heat-conducting structure 20 in the heat-absorbing zone 23 will be transmitted to the heat-dissipating zone 24 by heat conduction due to the temperatures differences between heat-conducting structures 20 in heat-absorbing zone 23 and heat-dissipating zone. When the low-temperature 91 enters the heat-dissipating zone 24 and flows through the spaces 22 between two adjacent heat-conducting structures 20, since the temperature of the low-temperature fluid 91 is lower than the temperature of the heat-conducting structure 20 in the heat-dissipating zone 24, the low-temperature fluid 91 absorbs the heat emitted from heat-conducting structures 20 within the heat-dissipating zone 24 through heat convention, whereby the temperature of the low-temperature fluid 91 can be increased.

[0028] After the low-temperature fluid 91 absorbs the heat, it will flow out the heat-dissipating zone 24 and can be conducted through the pipeline to an area where requires the heat energy, thereby dissipating absorbed heat to the area. Referring back to FIGS. 2A and 2B, it is noted that the heat-conducting metal layer 200 and heat-conducting support layer 201 can be prevented from the corrosion of the high-temperature fluid 90 through the protection of the heat-conducting protection layer 202. While, due to the support effect of the heat-conducting support layer 201, the heat-conducting efficiency of the heat-conducting metal layer 200 can be maintained high without influence of the thermal deformation, thereby increasing the heat-exchanging applications of the present heat-conducting structure 20.

[0029] It is understood that, although the heat-conducting structure 20 within the heat-absorbing area 23 and heat-dissipating area 24 shown in FIG. 1 is a multiple-layered metal structure, practically, it should be not limited to the multiple-layered metal structure. For instance, please refer to FIG. 2C, which illustrates an application that a part of the heat-conducting structure 20 is formed by a single layer structure that are accommodated with the heat-dissipating area, which is the heat-conducting metal layer 200 in the embodiment. In case of this application, the fluid passing through the heat-dissipating area 24 is not a type of corrosive fluid while the temperature of the heat-conducting metal layer 200 will not exceed its deformation temperature. It is noted that the heat-conducting metal layer 200 in the heat-dissipating zone 24 can be an independent layer coupled to the heat-conducting metal layer 200 in the heat-absorbing zone 23 or, alternatively, can be formed as a unit with the heat-conducting metal layer 200 in the heat-absorbing zone 23 during production. In addition, alternative embodiment shown in FIG. 2D, the heat-conducting structure 20 within the heat-dissipating zone 24 is a two-layered structure mainly having a heat-conducting metal layer 200 and heat-conducting support layer 201. In case of the embodiment shown in FIG. 2D, the fluid passing through the heat-dissipating area 24 is not a type of corrosive fluid; however, since the temperature of the heat-conducting metal layer 200 may be relatively higher than embodiment shown in FIG. 2C, which will have possibility to exceed the deformation temperature of the heat-conducting metal layer 200, the heat-conducting support layer 201 can be utilized to prevent the thermal deformation.

[0030] Furthermore, please refer to embodiments shown in FIGS. 3A and 3B, which respectively illustrate alternative types of heat-conducting structure according to the present invention. Unlike the flat and plate-shaped heat-conducting structure shown in FIG. 1, in the embodiment shown in FIGS. 3A and 3B, the heat-conducting structure respectively comprises a plurality of folded structures for enhancing a contact area between the fluid and heat-conducting structure, thereby improving the heat-conducting efficiency.

[0031] In an exemplary embodiments shown in FIG. 3A, the folded structure 204 having a plurality of polygonal structures respectively having a polygonal cross-section with two 90-degree angles. It is noted that the folded angle is not limited to 90-degree angle. For example, in an alternative embodiment shown in FIG. 3B, the folded structure 205 has a plurality of polygonal structures respectively having a top-folded angle formed by two folded sides smaller than the 90 degree while having a bottom-folded angle larger than 90 degree, whereby each polygonal structure forms a triangle structure. In addition, the folded structures 204 and 205 shown in FIGS. 3A and 3B are not limited to polygonal structures, wherein, alternatively, the folded structure can also be a curvature structure, or, alternatively, a combination of curvature structure and a polygonal structure.

[0032] Please refer to FIGS. 4A and 4B, which respectively illustrate alternative embodiments of heat exchanger and heat-conducting structure according to the present invention. In FIG. 4A, it illustrates an exemplary embodiment of heat exchanger having heat-conducting structures formed in shell-tube structures. The heat exchanger 4 comprises a housing 40, and a plurality of pipelines 41. The housing 40 has an entrance 400 for a high-temperature fluid 90 flowing therein, and an exit 401 for the high-temperature fluid 90 to flow thereout. The plurality of pipelines 41 formed inside the housing 40 are arranged spatially apart from each other with a specific distance between two adjacent pipelines 41 such that a heat-conducting space can be formed between two-adjacent pipelines 41 for allowing the high-temperature fluid 90 flowing therethrough.

[0033] In an embodiment, each pipeline 41 further has a plurality of heat-conducting fins 413 for enhancing the efficiency of heat conduction. It is noted that the embodiment shown in FIG. 4A is a cross-flow heat exchanger, i.e. a flow direction of the high-temperature fluid and a flow direction of the low-temperature fluid are cross to each other. In addition to the aforementioned cross-flow heat exchanger, the flow direction of the high-temperature and the flow direction of the
low-temperature can be, alternatively, the same as each other or, alternatively, be opposite to each other.

[0034] Please refer to the exemplary embodiment shown in FIG. 4B, which illustrates a cross-sectional view of the pipeline shown in FIG. 4A. The pipeline 41 further comprises a heat-conducting metal layer 410, a heat-conducting support layer 411, and a heat-conducting protection layer 412, wherein the heat-conducting metal layer 410 is formed to clad surfaces, including outer and inner surfaces, of the heat-conducting support layer 410, while the heat-conducting protection layer 412 is formed to clad the outer surface of the heat-conducting support layer 411 covering the outer surface of the heat-conducting metal layer 400, and clad inner surface of heat-conducting support layer 411 covering the inner surface of the heat-conducting metal layer 400.

[0035] The heat-conducting metal layer 410 can be, but should not be limited to, a copper, a silver, a gold, an aluminum, or an alloy combining the at least two kinds of aforementioned exemplary metals. The heat-conducting support layer 411 can be a ferro-alloy, such as stainless steel, or carbon steel. The heat-conducting protection layer 412 can be a nickel or nickel alloy. In one exemplary embodiment, the material of heat-conducting metal layer 410 is copper, the material of the heat-conducting support layer 411 is stainless steel, and the material of the heat-conducting protection layer 412 is nickel.

[0036] Please refer to FIG. 5A, which illustrates an alternative embodiment of the heat exchanger according to the present invention. In the present invention, basically, the heat exchanger 2 is similar to the embodiment shown in FIG. 1, whereas the difference is that the heat-conducting structure 20a is a column-shaped structure. Please refer to FIG. 5B, which illustrates a cross-sectional view of the column-shaped structure. The heat-conducting structure 20a is a three-layered structure comprising a heat-conducting metal layer 200, heat-conducting support layer 201 and a heat-conducting protection layer 202. The heat-conducting metal layer 200 shown in FIG. 5B is a solid structure which is formed to be a center of the heat-conducting structure 20a. The heat-conducting support layer 201 is formed to coat outer surface of the heat-conducting metal layer 200 while the heat-conducting protection layer 202 is formed to cover the outer surface of the heat-conducting support layer 201 such that the heat-conducting structure 20a is a solid heat-conducting structure.

[0037] Please refer to FIG. 6, which illustrates a heat-exchanging system according to an embodiment of the present invention. The heat-exchanging system 5 comprising at least one heat exchanger 50, a heat generator 51, and a heat storage device 52. Each heat exchanger 50 can be selected according to the embodiments respectively shown in FIG. 1, FIG. 4A or FIG. 5A. In the present embodiment, the embodiment shown in FIG. 1 is utilized to be the heat exchanger 50 shown in FIG. 6. The heat generator 51 provides a high-temperature fluid 90 having a temperature higher than the temperature of the heat-conducting structure 20 with the heat-absorbing area 23. The heat generator 51 can be a reactor, or a waste gas processing system which can be, but should not be limited to, a granular moving-bed apparatus.

[0038] In the present invention, the heat generator 51 is a granular moving-bed apparatus. When a waste gas flow 92 with high-temperature passes through the heat generator 51, the dust particles or contaminants inside the waste gas flow 92 are filtered out by the granular material moving inside the heat generator 51, thereby being formed a clean and high-temperature fluid 90. The high-temperature fluid 90 is further conducted to the heat exchanger 50, and, subsequently, the high-temperature fluid 90 enters the heat-absorbing zone 23, performs heat exchange with the heat-conducting structure 20 inside the heat-absorbing zone 23, and, subsequently, flows out the heat-absorbing zone 23.

[0039] On the other hand, after the heat-conducting structure 20 inside the heat-absorbing zone 23 absorbed the heat transmitted from the high-temperature fluid 90, the absorbed heat is conducted to the heat-conducting structures 20 inside the heat-dissipating zone 24 via heat conduction. The heat storage device 52 coupled to the heat-dissipating zone 24 of the heat exchanger 50 for receiving a low-temperature fluid 91 from the heat-dissipating zone 24 flowing therethrough. It is noted that the high-temperature fluid 90 and low-temperature fluid 91 can be a gas, a liquid, or a slurry. In the present embodiment, the fluid 90 and 91 are both gas.

[0040] The temperature of the low-temperature fluid 91 is lower than the temperature of the heat-conducting structures 20 inside the heat-dissipating zone 24. Accordingly, when the low-temperature fluid 91 passes through the heat-dissipating zone 24, the low-temperature fluid 91 absorbs heat from the heat-conducting structure 20 inside the heat-dissipating zone 24, thereby decreasing the temperature thereof. Thereafter, the fluid 91 is conducted to pass through the heat storage device 52. The heat storage device 52 coupled to the heat generator 51 comprises a granular material container 520 for accommodating clean granular material which moves into the heat generator 51 for filtering out the dust particles and contaminants within the waste gas flow 92. When the fluid 91 enters the heat storage device 52, it can flow through the granular material for preheating the granular material inside the granular material container 520, whereby the granular material can absorb heat from the fluid 91 so as to increase the temperature of the granular material, thereby enhancing the objective for preheating the granular material.

[0041] With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

What is claimed is:

1. A heat-conducting structure, comprising:
   a. a heat-conducting metal layer;
   b. a heat-conducting support layer, formed to clad and support a surface of the heat-conducting metal layer thereby preventing the heat-conducting metal layer from thermal deformation; and
   c. a heat-conducting protection layer, formed to clad a surface of the heat-conducting support layer.

2. The heat-conducting structure according to claim 1, wherein a thermal conductivity of the heat-conducting metal layer is in a range of 100 W/(m·K) to 400 W/(m·K).

3. The heat-conducting structure according to claim 1, wherein the heat-conducting support layer is formed by a ferro-alloy having a thermal conductivity in a range of 9 W/(m·K) to 26 W/(m·K).

4. The heat-conducting structure according to claim 1, wherein a thermal conductivity of the heat-conducting protection layer is in a range of 8 W/(m·K) to 72 W/(m·K).
5. The heat-conducting structure according to claim 1, which is formed in a plate-shaped structure, a column-shaped structure, or a shell-tube structure.

6. A heat exchanger, comprising:
a plurality of heat-conducting structures, arranged spatially apart from each other, wherein a heat-conducting space is formed between two adjacent heat-conducting structures;
a supporting part, arranged on the plurality of heat-conducting structures for dividing the plurality of heat-conducting structures into a heat-absorbing zone and a heat-dissipating zone;
each heat-conducting structures within the heat-absorbing zone further comprising:
a first heat-conducting metal layer;
a first heat-conducting support layer, formed to clad and support a surface of the first heat-conducting metal layer thereby preventing the first heat-conducting metal layer from thermal deformation; and
a first heat-conducting protection layer, formed to clad a surface of the first heat-conducting support layer.

7. The heat exchanger according to claim 6, wherein the heat-conducting structure in the heat-dissipating zone further comprises a second heat-conducting metal layer coupled to the first heat-conducting metal layer.

8. The heat exchanger according to claim 7, wherein the first heat-conducting metal layer and the second heat-conducting metal layer respectively have a thermal conductivity in a range of 100 W/(m·K) to 400 W/(m·K).

9. The heat exchanger according to claim 7, wherein the heat-conducting structure in the heat-dissipating zone further comprises a second heat-conducting support layer which is formed to clad a surface of the second heat-conducting metal layer and coupled to the first heat-conducting support layer.

10. The heat exchanger according to claim 9, wherein the first and second heat-conducting support layers are respectively formed by a ferro-alloy having a thermal conductivity in a range of 9 W/(m·K) to 26 W/(m·K).

11. The heat exchanger according to claim 9, wherein the heat-conducting structure in the heat-dissipating zone further comprises a second heat-conducting protection layer which is formed to clad a surface of the second heat-conducting support layer and coupled to the first heat-conducting protection layer.

12. The heat exchanger according to claim 11, wherein the first and second heat-conducting protection layer respectively have a thermal conductivity in a range of 8 W/(m·K) to 72 W/(m·K).

13. The heat exchanger according to claim 6, wherein each heat-conducting structure further comprises a plurality of folded structures.

14. The heat exchanger according to claim 6, wherein each heat-conducting structure is formed in a plate-shaped structure, a column-shaped structure, or a shell-tube structure.

15. A heat-exchanging system, comprising:
a heat exchanger, further comprising:
a plurality of heat-conducting structures, arranged spatially apart from each other, wherein a heat-conducting space is formed between two adjacent heat-conducting structures; and
a supporting part, arranged on the plurality of heat-conducting structures for dividing the plurality of heat-conducting structures into a heat-absorbing zone and a heat-dissipating zone, wherein each heat-conducting structures within the heat-absorbing zone further comprising: a first heat-conducting metal layer; a first heat-conducting support layer, formed to clad and support a surface of the first heat-conducting metal layer thereby preventing the first heat-conducting metal layer from thermal deformation; and a first heat-conducting protection layer, formed to clad a surface of the first heat-conducting support layer; and a heat generator, providing a first fluid to pass through the heat-absorbing zone such that the plurality of heat-conducting structures in the heat-absorbing zone absorbs heat from the first fluid, and conducts the absorbed heat to the heat-dissipating zone; and a heat storage device, coupled to the heat-dissipating zone of the heat exchanger, the heat storage device further receiving a second fluid passing through the heat-dissipating zone and absorbing the heat from the plurality of heat-conducting structures within the heat-dissipating zone.

16. The heat-exchanging system according to claim 15, wherein the heat-conducting structure in the heat-dissipating zone further comprises a second heat-conducting metal layer coupled to the first heat-conducting metal layer.

17. The heat-exchanging system according to claim 16, wherein the first heat-conducting metal layer and the second heat-conducting metal layer respectively have a thermal conductivity in a range of 100 W/(m·K) to 400 W/(m·K).

18. The heat-exchanging system according to claim 16, wherein the heat-conducting structure in the heat-dissipating zone further comprises a second heat-conducting support layer which is formed to clad a surface of the second heat-conducting metal layer and coupled to the first heat-conducting support layer.

19. The heat-exchanging system according to claim 18, wherein the first and second heat-conducting support layers are respectively formed by a ferro-alloy having a thermal conductivity in a range of 9 W/(m·K) to 26 W/(m·K).

20. The heat-exchanging system according to claim 18, wherein the heat-conducting structure in the heat-dissipating zone further comprises a second heat-conducting protection layer which is formed to clad a surface of the second heat-conducting support layer and coupled to the first heat-conducting protection layer.

21. The heat-exchanging system according to claim 20, wherein the first and second heat-conducting protection layer respectively have a thermal conductivity in a range of 8 W/(m·K) to 72 W/(m·K).

22. The heat-exchanging system according to claim 15, wherein the first fluid is a gas, a liquid, or a slurry.

23. The heat-exchanging system according to claim 15, wherein the second fluid is a gas, a liquid, or a slurry.

24. The heat-exchanging system according to claim 15, wherein the heat storage device is connected to a material container accommodating a material that is preheated by the second fluid absorbed heat from the heat-dissipating zone.

25. The heat-exchanging system according to claim 15, wherein each heat-conducting structure further comprises a plurality of folded structures.

26. The heat-exchanging system according to claim 15, wherein each heat-conducting structure is formed in a plate-shaped structure, a column-shaped structure, or a shell-tube structure.