HERMETIC COMPRESSOR AND REFRIGERATION SYSTEM

Yosuki Yoshimi, Kanagawa (JP)

Correspondence Address:
RATNERPRESTIA
P.O. BOX 980
VALLEY FORGE, PA 19482 (US)

Assignee: Panasonic Corporation, Osaka (JP)

Appl. No.: 12/297,706
PCT Filed: Apr. 28, 2008
PCT No.: PCT/JP2008/001112
§ 371 (c)(1), (2), (4) Date: Oct. 20, 2008

Foreign Application Priority Data
May 10, 2007 (JP) ................................ 2007-125339

Publication Classification
Int. Cl.
F25B 43/00 (2006.01)
F25B 1/00 (2006.01)
F04B 35/04 (2006.01)
F04B 39/00 (2006.01)

U.S. Cl. .......... 62/468; 62/498; 417/410.1; 417/312; 417/415

ABSTRACT
In a hermetic compressor, aggression to an organic material is low by using a refrigeration oil using, as a base oil, an alicyclic multivalent carboxylic acid ester compound and made of an alicyclic multivalent carboxylic acid ester compound having at least two ester groups, the at least two ester groups being bound to carbon atoms adjacent to each other on an alicyclic ring. The ratio of hydrocarbon radicals in which carbon number is 4 or less among hydrocarbon radicals bound to the at least two ester groups is 15% by weight or less.
FIG. 4
FIG. 7
HERMETIC COMPRESSOR AND REFRIGERATION SYSTEM

TECHNICAL FIELD

[0001] The present invention relates to a hermetic compressor and a refrigeration system using a refrigerant whose main component is a hydrofluorocarbon refrigerant and whose critical temperature is 40 degrees centigrade or higher.

BACKGROUND ART

[0002] In recent years, from the viewpoint of environmental pollution, particularly, ozone layer depletion and global warming, the use of chlorofluorocarbon is a control subject worldwide. For example, chlorofluorocarbon 12 used as a refrigerant of a refrigeration system such as a refrigerator or dehumidifier is also a control subject. As a refrigerant replacing chlorofluorocarbons, attention is being paid to hydrofluorocarbon (HFC) refrigerants which do not destroy the ozone layer and whose ozone depletion potential is 0. A representative refrigerant is HFC-134a. A conventional hermetic compressor and a conventional refrigeration system using HFC-134a use a refrigeration oil whose base oil is an alicyclic multivalent carboxylic acid ester compound. The techniques are disclosed in, for example, Patent Citation 1.

[0003] The conventional hermetic compressor and refrigeration system will be described below with reference to the drawings.

[0004] FIG. 6 is a configuration diagram of a conventional refrigeration system. In FIG. 6, a refrigeration system is constructed by connecting hermetic compressor 1, condenser 2, expansion mechanism 3, and evaporator 4 with pipes in order. In the refrigeration system, a refrigerant is sealed.

[0005] FIG. 7 is a vertical cross-sectional view of the hermetic compressor. In FIG. 7, hermetic compressor 1 houses, in hermetic container 5, compression element 6, electric element 7 for driving compression element 6, and refrigeration oil 8 for sliding lubrication of hermetic compressor 1 and sealing of a compression chamber.

[0006] The operation of the hermetic compressor and the refrigeration system constructed as described above will be described below.

[0007] In hermetic compressor 1, electric element 7 drives compression element 6, thereby compressing a low-temperature low-pressure gaseous refrigerant. The resultant refrigerant is discharged as a high-temperature high-pressure gaseous refrigerant and sent to condenser 2. The gaseous refrigerant sent to condenser 2 becomes a high-temperature high-pressure liquid refrigerant while emitting its heat into the air, and the high-temperature high-pressure liquid refrigerant is sent to expansion mechanism 3. The high-temperature high-pressure liquid refrigerant passing through expansion mechanism 3 becomes a low-temperature low-pressure wet steam by a diaphragm effect, and the low-temperature low-pressure wet steam is sent to evaporator 4. The refrigerant in evaporator 4 absorbs heat from the environment and evaporates. The refrigerant on the low-temperature low-pressure gas from evaporator 4 is sucked by hermetic compressor 1. After that, the same cycle is repeated.

[0008] In the conventional example, HFC-134a is used as the refrigerant. The kinetic viscosity of the HFC-134a is 2 to 70 cSt at 40 degrees centigrade, and 1 to 9 cSt at 100 degrees centigrade. The HFC-134a has at least two ester groups in the molecule. At least two ester groups are bound to carbon atoms adjacent to each other on an alicyclic ring. Further, refrigeration oil 8 is also employed. Refrigeration oil 8 uses, as a base oil, an alicyclic multivalent carboxylic acid ester compound whose carbon number is 1 to 30 among hydrocarbon radicals bound to at least two ester groups. The lower critical temperature of refrigeration oil 8 is 0 degree or less or ±30 degrees centigrade or lower.

[0009] Consequently, also in the case of using the HFC-134a in a low-temperature refrigeration system such as a refrigerator, refrigeration oil 8 and the refrigerant are very compatible without being separated from each other over the whole temperature range of the use environment. Therefore, the refrigerant heat transmitting performance and reliability of a lubricating oil film between the shaft of hermetic compressor 1 and the bearing and a heat exchanger can be remarkably improved.

[0010] However, in the case of lowering the kinetic viscosity of refrigeration oil 8 used for the conventional configuration, although it is effective means to reduce the carbon number of the hydrocarbon radical bound to the ester group, when the carbon number decreases, steric hindrance of the molecule decreases. Therefore, aggression to an organic material increases. It causes extraction from the organic material, occurrence of a sludge accompanying the extraction, and clogging in a capillary.

DISCLOSURE OF INVENTION

[0012] The present invention provides a very reliable hermetic compressor and refrigeration system by suppressing aggression of a refrigeration oil to an organic material. In the hermetic compressor and the refrigeration system of the present invention, the ratio of the carbon number of the hydrocarbon radical bound to the ester group of the refrigeration oil using the alicyclic multivalent carboxylic acid ester compound as a base oil is controlled.

[0013] With the configuration, aggression of the refrigeration oil to an organic material can be suppressed. Thus, the hermetic compressor and the refrigeration system of the present invention have the effect that extraction from an organic material is reduced.

BRIEF DESCRIPTION OF DRAWINGS

[0014] FIG. 1 is a vertical cross-sectional view of a hermetic compressor in a first embodiment of the present invention.

[0015] FIG. 2 is a configuration diagram of a refrigeration system in the first embodiment of the present invention.

[0016] FIG. 3 is a diagram showing the relation between the carbon number of a hydrocarbon radical and the swelling ratio of an organic material in the first embodiment of the present invention.

[0017] FIG. 4 is a vertical cross-sectional view of a hermetic compressor in a second embodiment of the present invention.

[0018] FIG. 5 is a configuration diagram of a refrigeration system in the second embodiment of the present invention.

[0019] FIG. 6 is a configuration diagram of a conventional refrigeration system.
FIG. 7 is a vertical cross-sectional view of a conventional hermetic compressor.

EXPLANATION OF REFERENCE

101, 201 Hermetic compressor
102, 202 Hermetic container
103, 203 Refrigeration oil
104, 204 Electric element
105, 205 Compression element
106, 206 Condenser
107, 207 Expansion mechanism
108, 208 Evaporator
109, 209 Refrigerant
110, 210 Suction muffler

BEST MODE FOR CARRYING OUT THE INVENTION

The embodiments of the present invention will be described hereinbelow with reference to the drawings. The invention is not limited to the embodiments.

MODE FOR THE INVENTION

FIG. 1 is a vertical cross-sectional view of a hermetic compressor in a first embodiment of the present invention. FIG. 2 is a configuration diagram of a refrigeration system in the first embodiment of the present invention.

In FIGS. 1 and 2, hermetic compressor 101 accumulates, in hermetic container 102, refrigeration oil 103 and houses electric element 104 and compression element 105 driven by electric element 104.

The refrigeration system of the first embodiment is constructed by connecting hermetic compressor 101, condenser 106, expansion mechanism 107, and evaporator 108 with pipes in order. Refrigerant 109 is a hydrofluorocarbon refrigerant and sealed in the refrigeration system of the first embodiment.

The operation and action of hermetic compressor 101 and the refrigeration system constructed as described above will be explained below.

In hermetic compressor 101, when electric element 104 drives compression element 105, low-temperature low-pressure gaseous refrigerant 109 is sucked into compression chamber 111 via suction muffler 110 as a muffler and compressed in compression chamber 111. The resultant refrigerant is discharged as high-temperature high-pressure gaseous refrigerant 109 from compression chamber 111. Discharged refrigerant 109 is led to the outside of hermetic compressor 101 via D line 112 that attenuates ripples and sent to condenser 106. Gaseous refrigerant 109 sent to condenser 106 becomes high-temperature high-pressure liquid refrigerant 109 while emitting its heat into the air. The high-temperature high-pressure liquid refrigerant is sent to expansion mechanism 107.

In compression element 105, crankshaft 113 press-fitted to electric element 104 rotates, and eccentric motion of eccentric shaft 114 of crankshaft 113 is transmitted from connecting rod 115 as a coupling part to piston 117 via piston pin 116. Piston 117 reciprocates in cylindrical bore 119 formed in block 118 and compresses refrigerant 109 in compression chamber 111 in an opening/closing process of valve 120.

In expansion mechanism 107, a capillary tube having a diameter of 0.6 mm is used. High-temperature high-pressure liquid refrigerant 109 passing through expansion mechanism 107 is rapidly decompressed, thereby becoming low-temperature low-pressure liquid refrigerant 109. Liquid refrigerant 109 is sent to evaporator 108 and becomes low-temperature low-pressure gaseous refrigerant 109 while absorbing heat in the air. Further, gaseous refrigerant 109 is sent to hermetic compressor 101. In such a manner, the operation of the refrigerating cycle is performed.

In the refrigeration system, HFC-134a as a hydrofluorocarbon refrigerant is used as refrigerant 109. As the base oil of refrigeration oil 103, an alicyclic multivalent carboxylic acid ester compound having a kinetic viscosity at 40 degrees centigrade of 2 to 70 eSt, and at 100 degrees centigrade of 1 to 9 eSt is chosen. It was confirmed that there is no problem in performance and reliability of hermetic compressor 101 when the kinetic viscosity is thus chosen.

The two-phase separation temperature between the alicyclic multivalent carboxylic acid ester compound and the hydrofluorocarbon refrigerant is –35 degrees centigrade or lower at lower critical temperature and 70 degrees centigrade or higher at upper critical temperature. Therefore, the two-phase separation does not occur at a temperature higher than –35 degrees centigrade of the evaporator temperature and equal to or lower than 70 degrees centigrade of the condenser temperature. Therefore, refrigeration oil 103 does not reside and a very reliable system is provided as a refrigeration system.

The alicyclic multivalent carboxylic acid ester compound used for refrigeration oil 103 has an alicyclic ring and at least two ester groups expressed by the following general formula (1). At least two ester groups are bound to carbon atoms adjacent to each other on the alicyclic ring.

\[
\text{COOR}_1
\]

where R1 denotes a hydrocarbon radical.

Examples of the alicyclic rings may include cyclopentane ring, cyclohexane ring, cycloheptane ring, and the like. After making examinations, it was understood that the cyclohexane ring is preferable.

In the case of lowering viscosity of refrigeration oil 103, it is one of effective means to decrease the carbon number of the hydrocarbon radical bound to the ester group in the alicyclic multivalent carboxylic acid ester compound. However, when the carbon number decreases, organic material extractability becomes high for the following reason. The smaller the carbon number of R1 becomes, the smaller the three-dimensional structure of the alicyclic multivalent carboxylic acid ester molecule becomes. The alicyclic multivalent carboxylic acid ester molecule penetrates the organic material more easily, and oligomer and the like in the organic material is extracted.

Therefore, by setting the ratio that the carbon number of the hydrocarbon radical bound to the ester group in the alicyclic multivalent carboxylic acid ester compound is four or less to 15% by weight or less, the alicyclic carboxylic acid ester compound whose aggressiveness to the organic material is suppressed can be obtained.

FIG. 3 is a diagram showing the relation between the carbon number of a hydrocarbon radical and the swelling ratio of an organic material in the first embodiment of the present invention. In FIG. 3, C1, C4, C8 and C9 denotes a hydrocarbon radical whose carbon number is 1, 4, 8 and 9, respectively, and content ratio is the ratio of C1, C4, C8 and
C9 among all hydrocarbon radicals. FIG. 3 shows the result of evaluation of a shield tube test between HFC-134a and refrigeration oil 103.

[0047] In FIG. 3, in the case where the alicyclic multivalent carboxylic acid ester compound in which the carbon number of R1 is 4 or less is 15% by weight or less, penetration to an organic material is small and the swelling ratio is low. That is, the result is excellent. It was understood that, however, when the compound exceeds 20% by weight, penetration to an organic material increases, and the swelling ratio increases.

[0048] Increase in the swelling ratio denotes that refrigeration oil 103 penetrates an organic material, and components in the organic material are extracted to the outside. Therefore, since an organic material is included in hermetic compressor 101, refrigeration oil 103 having a low organic material swelling ratio has to be chosen. It was understood from the experiment result that, the proper ratio that the carbon number of R1 is 4 or less is 15% by weight or less.

[0049] A life test was conducted in a refrigeration system constructed by hermetic compressor 101, condenser 106, expansion mechanism 107, and evaporator 108. As conventional refrigeration oil 103, an alicyclic carboxylic acid ester compound of 25% by weight in which the carbon number of R1 is 4 was used. On the other hand, as refrigeration oil 103 of the hermetic compressor in the first embodiment, an alicyclic multivalent carboxylic acid ester compound in which the ratio that the carbon number of R1 is 4 or less is 15% by weight was used.

[0050] As an enameled copper wire of electric element 104, an upper-layer polyamide-imide/lower-layer polyester imide (Al/EI) copper wire was used. As an insulating film, polyethylene terephthalate was used. Low-oligomer polyethylene terephthalate was used for suction muffler 110 of compression element 105. Nitrile rubber was used as vibration-proof rubber 121 used for preventing D line 112 from being vibrated as a rubber part used in hermetic container 102.

[0051] As a result, the capillary flow decrease ratio could be reduced to 1/6 of the conventional one, and no generation of a sludge was recognized on valve 120.

[0052] Further, at the time of lowering viscosity of refrigeration oil 103, monoseater was added by 5 to 30% by weight. Consequently, without increasing the ratio that the carbon number of R1 is 4 or less, the kinetic viscosity can be easily lowered, and aggression to an organic material when the viscosity of refrigeration oil 103 is low can be suppressed.

[0053] The upper-layer polyamide-imide/lower-layer polyester imide (Al/EI) copper wire was used as an enameled copper wire in electric element 104 of hermetic compressor 101, and polyethylene terephthalate was used as an insulating film. Also in the case of using a upper-layer polyamide-imide/lower-layer modified polyester (Al/HPE) as the enameled wire or in the case of using, as an insulating film, one of materials of polyethylene naphthalate, polyamide-imide coat polyester, polyphenylene sulfide, and polyether ether ketone, the capillary flow decrease ratio could be reduced to 1/6 of conventional one. Further, breakdown retention evaluation was made and it was understood that the retention was 95% or higher and there is no problem of degradation.

[0054] For suction muffler 110 of compression element 105 in hermetic compressor 101, low-oligomer polyethylene terephthalate was used. Also in the case of using any of polyethylene terephthalate containing no paraffin, polyethylene naphthalate, polyamide-imide coat polyester, polyphenylene sulfide, and polyether ether ketone, the capillary flow decrease ratio could be reduced to 1/6 of conventional one. Moreover, since the materials have thermal conductivity lower than that of metals, it contributes to improve the performance of hermetic compressor 101.

[0055] As the rubber part used in hermetic container 102 in hermetic compressor 101, nitrile rubber was used. Also in the case of using any one of hydrogenated nitrile rubber and fluorine rubber, similar effects could be obtained.

[0056] Further, refrigeration oil 103 containing an additive was evaluated. A forming agent, antioxidant agent, and extreme-pressure additive agent were used as the additives and the capillary flow decrease ratio in the life test was recognized. 20 to 100 ppm of dimethylisoxiane having a kinetic viscosity of 40 to 100 cSt as the foaming agent, 0.05 to 0.2 wt % of dibutyl paracresol (DBPC) as the antioxidant agent, and 0.05 to 0.3 wt % of tricresyl phosphate (TCP) as the extreme-pressure additive agent were added. As a result, the capillary flow decrease ratio was 5% or less, and it could be confirmed that there is no problem in sound and sliding.

[0057] Further, the behavior of a sliding part used for hermetic compressor 101 in a state where HFC-134a and the alicyclic carboxylic acid ester compound coexist was evaluated. The sliding part of hermetic compressor 101 was evaluated by an environment abrasion tester in a state where refrigerant 109 and refrigeration oil 103 coexist.

[0058] Gray cast iron FC-200 was used as the material of block 118, spheroidal graphite cast iron was used as the material of crankshaft 113, a sintered metal whose hardness is HRB70 was used as the material of piston 117, high-silicon aluminum ADC14 was used as the material of connecting rod 115, and chrome molybdenum steel SCM415 was used as the material of piston pin 116. Since cast metals are easily adhered to each other because they are metals of the same kind, phosphate coating process is performed on one of the metals to address sliding of the cast metals.

[0059] As a result, the wear amount due to sliding was 5 μm or less in any of combinations of gray cast iron FC-200 (one-side phosphate coating process), FC-200 (surface phosphate coating process) and FCD-500, FC-200 and FCD-500 (surface phosphate coating process), FC-200 and a sintered metal, FC-200 and ADC14, FCD-500 and ADC14, and ADC-14 and carburized SCM415. It could be confirmed that there is no problem.

[0060] As described above, by using high-reliable refrigeration oil 103, high-reliable hermetic compressor 101 and refrigeration system could be provided.

**MODE FOR THE INVENTION 2**

[0061] FIG. 4 is a vertical cross-sectional view of a hermetic compressor in a second embodiment of the present invention. FIG. 5 is a configuration diagram of a refrigeration system in the second embodiment of the present invention. In FIGS. 4 and 5, hermetic compressor 201 accumulates, in hermetic container 202, refrigeration oil 203 and houses electric element 204 and compression element 205 driven by electric element 204.

[0062] The refrigeration system of the second embodiment is constructed by connecting hermetic compressor 201, condenser 206, expansion mechanism 207, and evaporator 208 with pipes in order. Refrigerant 209 is a hydrofluorocarbon refrigerant and sealed in the refrigeration system of the second embodiment.
The operation and action of hermetic compressor 201 and the refrigeration system constructed as described above will be explained below. In hermetic compressor 201, when electric element 204 drives compression element 205, low-temperature low-pressure gaseous refrigerant 209 is sucked into compression chamber 211 via suction muffler 210 as a muffler and compressed in compression chamber 211. The resultant refrigerant is discharged as high-temperature high-pressure gaseous refrigerant 209 from compression chamber 211. Discharged refrigerant 209 is sent to condenser 206. It becomes high-temperature high-pressure liquid refrigerant 209 while emitting its heat into the air, and the high-temperature high-pressure liquid refrigerant is sent to expansion mechanism 207.

In expansion mechanism 207, a capillary tube having a diameter of 0.6 mm is used. High-temperature high-pressure liquid refrigerant 209 passing through expansion mechanism 207 is rapidly decompressed, thereby becoming low-temperature low-pressure liquid refrigerant 209. Liquid refrigerant 209 is sent to evaporator 208 and becoming low-temperature low-pressure gaseous refrigerant 209 while absorbing heat in the air. Further, gaseous refrigerant 209 is sent to hermetic compressor 201. In such a manner, the operation of the refrigerating cycle is performed.

In the refrigeration system, HFC-134a as a hydrofluorocarbon refrigerant is used as refrigerant 209. As the base oil of refrigeration oil 203, an alicyclic multivalent carboxylic acid ester compound whose kinetic viscosity is 2 to 70 cSt at 40 degrees centigrade, and 1 to 9 cSt at 100 degrees centigrade and whose two-phase separation temperature is 35 degrees centigrade or lower at the lower critical temperature and is 70 degrees centigrade or higher at the upper critical temperature is used. That is, refrigeration oil having an alicyclic ring and at least two ester groups expressed by the above general formula (1), the at least two ester groups bound to carbon atoms adjacent to each other on the alicyclic ring, is used.

Examples of the alicyclic rings may include cyclopentane ring, cyclohexane ring, cyclohexane ring, and the like. After examinations, it was understood that the cyclohexane ring is preferable.

This time, a case is assumed that hermetic compressor 201 was replaced in service repair or the like in the market, ester oil obtained by reaction between an aliphatic alcohol and a fatty acid was used before the replacement, and the ester oil was mixed with refrigeration oil 203 sealed in newly attached hermetic compressor 201. The characteristics of refrigeration oil 203 were confirmed using refrigeration oil 203 mixed with the ester oil obtained by reaction between aliphatic alcohol and fatty acid.

Table 1 shows the result of evaluation made in a shield tube test between HFC-134a and refrigeration oil 203. Here, refrigeration oil 203 is a same refrigeration oil of Embodiment 1.

<table>
<thead>
<tr>
<th>Mixing ratio (%) by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>Hue</td>
</tr>
<tr>
<td>Total acid number</td>
</tr>
</tbody>
</table>

It is understood from Table 1 that, when the mixture ratio of the ester oil obtained by the reaction between aliphatic alcohol and fatty acid is 0% to 50% by weight, the characteristics of refrigeration oil 203 are stable. It means that, at the time of replacing hermetic compressor 201 for service or the like, hermetic compressor 201 can be simply replaced without washing the inside of the refrigeration system.

Further, a life test was conducted in a refrigeration system constructed by hermetic compressor 201, condenser 206, expansion mechanism 207, and evaporator 208. In the test, refrigeration oil 203 in which 50% by weight of the ester oil obtained by the reaction between aliphatic alcohol and fatty acid is mixed was used. As a result, the capillary flow decrease ratio could be reduced to 1/6 of the conventional one. That is, since there is hardly any influence on the characteristics of refrigeration oil 203 of the ester oil obtained by the reaction between aliphatic alcohol and fatty acid, aggression to an organic material can be suppressed.

As described above, by using high-reliable refrigeration oil 203, high-reliable hermetic compressor 201 and the refrigeration system can be realized.

**INDUSTRIAL APPLICABILITY**

In the hermetic compressor and the refrigeration system of the present invention, aggression to an organic material can be suppressed. Thus, the high-reliable hermetic compressor and the refrigeration system can be provided and the invention can be widely applied to devices each using a refrigeration system.

1. A hermetic compressor comprising:
   - a hermetic container;
   - a refrigeration oil stored in the hermetic container;
   - an electric element housed in the hermetic container;
   - a compression element driven by the electric element; and
   - a refrigerant compressed by the compression element, wherein the refrigerant contains a hydrofluorocarbon as a main component and has a critical temperature of 40 degrees centigrade or higher,
   - a base oil of the refrigeration oil is an alicyclic multivalent carboxylic acid ester compound having a kinetic viscosity of 2 to 70 cSt at 40 degrees centigrade and 1 to 9 cSt at 100 degrees centigrade and whose temperature of separation from the refrigerant is 35 degrees centigrade or lower at a lower critical temperature and 70 degrees centigrade or higher at an upper critical temperature, the alicyclic multivalent carboxylic acid ester compound has at least two ester groups, the at least two ester groups are bound to carbon atoms adjacent to each other on an alicyclic ring and, further, the ratio of hydrocarbon radicals in which carbon number is 4 or less among hydrocarbon radicals bound to the at least two ester groups is 15% by weight or less.

2. The hermetic compressor according to claim 1, wherein the refrigeration oil is obtained by mixing monoester oil in the range of 5 to 30% by weight.

3. The hermetic compressor according to claim 1, wherein the electric element comprises:
   - an enameled copper wire; and
   - an insulating film,
   the enameled copper wire has one of an upper-layer polyamide-imide/lower-layer polyester imide copper wire and upper-layer polyamide-imide/lower-layer modified polyester copper wire, and
the insulating film is made of any one of polyethylene terephthalate, polyethylene naphthalate, polyamide-imide coat polyester, polyphenylene sulfide, and polyether ether ketone.

4. The hermetic compressor according to claim 1, wherein the compression element has a suction muffler, and the suction muffler is made of any one of low oligomer polyethylene terephthalate, polyethylene naphthalate, polyamide-imide coat polyester, polyphenylene sulfide, and polyether ether ketone.

5. The hermetic compressor according to claim 1, further comprising a rubber part in the hermetic container, and the rubber part is made of any of nitrile rubber, hydrogenated nitrile rubber, and fluororubber.

6. The hermetic compressor according to claim 1, wherein the compression element has a sliding part, and the sliding part is made of any one of combination of gray cast irons, combination of the gray cast iron and a spheroidal graphite cast iron, combination of the gray cast iron and a sintered metal, combination of the gray cast iron and high-silicon aluminum material, combination of the spheroidal graphite cast iron and the high-silicon aluminum, combination of the high-silicon aluminum material and a chrome molybdenum steel material subjected to a carburizing process, and combination of the high-silicon aluminum material and the chrome molybdenum steel material subjected to a nitriding process.

7. The hermetic compressor according to claim 1, wherein the refrigeration oil contains an antioxidant agent.

8. The hermetic compressor according to claim 1, wherein the refrigeration oil contains an extreme-pressure additive agent.

9. The hermetic compressor according to claim 1, wherein the refrigeration oil contains an extreme-pressure additive agent.

10. A refrigeration system comprising:
    the hermetic compressor according to claim 1;
    an evaporator;
    a condenser; and
    an expansion mechanism.

11. The refrigeration system according to claim 10, wherein the refrigeration oil is mixed with ester oil, and the ester oil is obtained by a reaction between an aliphatic alcohol and a fatty acid whose temperature of two-phase separation from a hydrofluorocarbon refrigerant is -35 degrees centigrade or lower at a lower critical temperature and 70 degrees centigrade or higher at an upper critical temperature.

12. The refrigeration system according to claim 11, wherein the refrigeration oil is mixed with 1 to 50% by weight of the ester oil.

13. The refrigeration system according to claim 10, wherein the expansion mechanism has a capillary tube.

14. The hermetic compressor according to claim 2, wherein the electric element comprises:
    an enameled copper wire; and
    an insulating film,

the enameled copper wire has one of an upper-layer polyamide-imide/lower-layer polyester imide copper wire and upper-layer polyamide-imide/lower-layer modified polyester copper wire, and the insulating film is made of any one of polyethylene terephthalate, polyethylene naphthalate, polyamide-imide coat polyester, polyphenylene sulfide, and polyether ether ketone.

15. The hermetic compressor according to claim 2, wherein the compression element has a suction muffler, and the suction muffler is made of any one of low oligomer polyethylene terephthalate, polyethylene terephthalate containing no paraflin, polyethylene naphthalate, polyamide-imide coat polyester, polyphenylene sulfide, and polyether ether ketone.

16. The hermetic compressor according to claim 2, further comprising a rubber part in the hermetic container, and the rubber part is made of any of nitrile rubber, hydrogenated nitrile rubber, and fluororubber.

17. The hermetic compressor according to claim 2, wherein the compression element has a sliding part, and the sliding part is made of any one of combination of gray cast irons, combination of the gray cast iron and a spheroidal graphite cast iron, combination of the gray cast iron and a sintered metal, combination of the gray cast iron and high-silicon aluminum material, combination of the spheroidal graphite cast iron and the high-silicon aluminum, combination of the high-silicon aluminum material and a chrome molybdenum steel material subjected to a carburizing process, and combination of the high-silicon aluminum material and the chrome molybdenum steel material subjected to a nitriding process.

18. The hermetic compressor according to claim 2, wherein the refrigeration oil contains a foaming agent.

19. The hermetic compressor according to claim 2, wherein the refrigeration oil contains an antioxidant agent.

20. The hermetic compressor according to claim 2, wherein the refrigeration oil contains an extreme-pressure additive agent.

21. A refrigeration system comprising:
    the hermetic compressor according to claim 2;
    an evaporator;
    a condenser; and
    an expansion mechanism.

22. The refrigeration system according to claim 21, wherein the refrigeration oil is mixed with ester oil, and the ester oil is obtained by a reaction between an aliphatic alcohol and a fatty acid whose temperature of two-phase separation from a hydrofluorocarbon refrigerant is -35 degrees centigrade or lower at a lower critical temperature and 70 degrees centigrade or higher at an upper critical temperature.

23. The refrigeration system according to claim 22, wherein the refrigeration oil is mixed with 1 to 50% by weight of the ester oil.

24. The refrigeration system according to claim 21, wherein the expansion mechanism has a capillary tube.

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