A golf club head includes a first metallic member, a second metallic member having different thickness from the first metallic member, and a part where the first and second metallic members are welded by plasma welding, laser welding or electron beam welding. A gap between the first and second metallic members is filled up with another metal material besides the first and second metallic members.
GOLF CLUB HEAD AND ITS MANUFACTURING METHOD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

The present invention relates to a golf club head having a part where the metallic members with different thickness are welded by plasma welding, laser welding or electron beam welding and its manufacturing method.

[0002] 2. Description of the Related Art

Conventionally, there is a golf club head having a part where the metallic members are welded together, in which a face, a crown, a sole, and a hosel are welded by TIG welding, MIG welding, laser welding or electron beam welding (refer to JP-A-5-15620).

However, when the metallic members were welded together by TIG welding or MIG welding, there was a problem that the weight control for the golf club head was difficult because a welding rod was employed and there was a sink in the weld zone.

Moreover, when the metallic members were welded together by laser welding or electron beam welding, there was a problem that the cost required for machining the metallic members was increased, because it was necessary to machine in advance the metallic members precisely so as not to cause a gap between the metal materials at the time of welding, although the weight control for the golf club head was easy because it was unnecessary to employ the welding rod and there was no sink in the weld zone. Especially when the metallic members with different thickness were welded by laser welding or electron beam welding, the above-mentioned machining was difficult, and the cost required for machining the metallic members was very high.

SUMMARY OF THE INVENTION

[0007] The invention provides a golf club head having a part where the metallic members with different thickness are welded by plasma welding, laser welding or electron beam welding, in which it is unnecessary to machine in advance the metallic members precisely so as not to cause a gap between the metallic members at the time of welding, and its manufacturing method.

[0008] According to an aspect of the present invention, a golf club head includes a first metallic member, a second metallic member having different thickness from the first metallic member, and a part where the first and second metallic members are welded by plasma welding, laser welding or electron beam welding. A gap between the first and second metallic members is filled up with another metal material besides the first and second metallic members.

[0009] According to another aspect of the present invention, a manufacturing method of a golf club head, which includes a first metallic member, and a second metallic member having different thickness from the first metallic member, the manufacturing method includes welding the first and second metallic members by plasma welding, laser welding or electron beam welding, and filling up a gap between the first and second metallic members with another metal material besides the first and second metallic members.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a perspective view showing a golf club head according to a first embodiment of the present invention;

[0011] FIG. 2 is a cross-sectional view of the golf club head of FIG. 1, taken along the line X-X in FIG. 1;

[0012] FIG. 3 is a perspective view of a face member for the golf club head of FIG. 1;

[0013] FIG. 4 is an enlarged view of a weld zone for the golf club head of FIG. 1;

[0014] FIG. 5 is an exploded perspective view showing a golf club head according to a second embodiment of the invention;

[0015] FIG. 6 is a perspective view showing a golf club head according to a third embodiment of the invention; and

[0016] FIG. 7 is an exploded perspective view showing a golf club head according to a fourth embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] As the plasma welding of the invention, the well-known plasma welding may be employed in which the members to be welded are dissolved and resolidified due to high temperature energy caused by plasma arc. As the laser welding, the well-known laser welding may be employed in which a gas laser such as CO laser or CO₂ laser, or a solid laser such as YAG laser is used. Also, as the electron beam welding, the well-known electron beam welding may be employed in which the electron beam of appropriate output is used.

[0018] In the invention, the method of performing the plasma welding, laser welding or electron beam welding while filling up a gap between the metallic members with another metal material is not limited, but may be implemented as the method of forming the plasma welding, laser welding or electron beam welding, using a wire rod of another metal material, while filling up a gap between the metallic members with metal forming the wire rod. In this case, the wire rod of another metal material may suitably have a diameter from 0.5 to 3.5 mm, particularly from 1.0 to 2.5 mm. Also, when the plasma welding is employed, it is preferred that another metal material is added between the joined members to provide a weld overlay at the juncture, because the weldability and the welding strength are increased even if the dimensional precision between the welded members is bad.

[0019] In the invention, a difference in thickness between the metallic members to be welded is appropriately from 0.1 to 1.5 mm, particularly from 0.2 to 0.6 mm.

[0020] In the invention, the metallic members with different thickness may be selected from among titanium, titanium alloy, aluminum and stainless steel. Also, another metal material for filling up a gap between the metallic members with different thickness may be selected from among titanium, titanium alloy, aluminum and stainless steel. Another metal material for filling up a gap between the metallic members with different thickness is essentially the metal material separate from the metallic members with
different thickness, and may or may not the same metal as one or both of the metallic members with different thickness.

[0021] Specifically, another metal material is preferably a dissimilar metal that is equivalent at 60% or more of metal composition, particularly at 80% or more to one or both of the metallic members with different thickness. Also, another metal material may be suitably the metal material similar to the metallic members with different thickness, or its alloy, with a difference in the melting point being from 0 to 200°C, particularly from 0 to 150°C.

[0022] The metallic members with different thickness and another metal material may be selected from among the metals having the following compositions (1) to (8), but are not limited to them. Among others, the combinations of (1) and (4), (2) and (4), (3) and (4), and (8) and (8) are particularly preferable.

[0023] (1) Ti735 (Ti17)
[0024] Ti-5Al-2Sn-2Zr-4Mo-4Cr (other than Ti at 17%)
[0025] (2) SAT2041
[0026] Ti-20V-4Al-1Sn (other than Ti at 25%)
[0027] (3) SP700
[0028] Ti-4.5Al-3V-2Fe-2Mo (other than Ti at 11.5%)
[0029] (4) 6-4Ti
[0030] Ti-6Al-4V (other than Ti at 10%)
[0031] (5) 10-2-3
[0032] Ti-10V-2Fe-3Al (other than Ti at 15%)
[0033] (6) 15-5-3Ti
[0034] Ti-15Mo-5Zr-5Al (other than Ti at 23%)
[0035] (7) 15-3-3-3
[0036] Ti-15V-3Cr-3Sn-3Al (other than Ti at 24%)
[0037] (8) SUS630
[0038] 17Cr-4Ni-4Cu—Nb (about 25% of remaining part is Fe and a trace quantity of Nb is added)

[0039] In the invention, the metallic members with different thickness to be welded are suitably a combination of cast member and forged member, a combination of cast member and press-formed member (metal material formed by press working a plate), or a combination of forged member and press-formed member, but not limited to them.

[0040] In the invention, a part where the metallic members with different thickness are welded by plasma welding, laser welding or electron beam welding may be made to extend across at least two sections selected from a face a sole, a crown, a toe, a heel, a side, a top blade and a hosel. For example, the part where the metallic members with different thickness are welded may be made to extend across the face and the crown, the face, the top blade and the toe, or the face, the sole and the toe, as described in the following embodiment.

[0041] The golf club head of the invention may be a wood type golf club head having a hollow portion, an iron type golf club head, or a composite golf club head made of fiber reinforced resin and metal.

[0042] The preferred embodiments of the present invention will be described below with reference to the drawings. However, the invention is not limited to the following embodiments.

FIRST EMBODIMENT

[0043] FIG. 1 is a perspective view showing a golf club head according to a first embodiment of the invention. FIG. 2 is a cross-sectional view of the golf club head of FIG. 1, taken along the line X-X in FIG. 1. FIG. 3 is a perspective view of a face member of the golf club head of FIG. 1. The golf club head of this embodiment is formed into the wood type golf club head having a hollow portion.

[0044] The golf club head of this embodiment includes a head main body 14 made of titanium alloy (specifically 6-4Ti) having a face opening portion 12 on a face side 10 and a face member 16 made of titanium alloy (specifically Ti735) for closing the face opening portion 12.

[0045] The golf club head of this embodiment has an upper edge of the face opening portion 12 and an upper edge of the face member 16 extending to a crown portion. Accordingly, when the face portion 16 is fixed to a peripheral portion of the face opening portion 12 for the head main body 14, an upper edge 18 of the face member 16 constitutes a part of the crown portion in the golf club head.

[0046] In the golf club head of this embodiment, the thickness P of the face member 16 is greater by 0.3 mm than the thickness Q of the peripheral portion of the face opening portion for the head main body 14.

[0047] Also, in the golf club head of this embodiment, the face main body 14 and the face member 16 are welded by plasma welding while a gap between them is filled up with another metal material (specifically a wire rod having a diameter of 5 mm and made of 6-4Ti, like the head main body 14). Accordingly, the gap between the head main body 14 and the face member 16 is filled up with another metal material 20, as shown in FIG. 4.

SECOND EMBODIMENT

[0048] FIG. 5 is an exploded perspective view showing a golf club head according to a second embodiment of the invention. The golf club head of this embodiment is formed into the iron type golf club head.

[0049] The golf club head of this embodiment includes a head main body 34 (cast member of SUS630) having a face opening portion 32 on a face side 30 and a face member 36 (rolled member of SUS630) for closing the face opening portion 32.

[0050] In the golf club head of this embodiment, when the face member 36 is fixed to a peripheral portion of the face opening portion 32 for the head main body 34, an upper edge 38 of the face member 36 constitutes a part of the top blade portion for the golf club head and a leading edge 40 of the face member 36 constitutes a part of the toe portion for the golf club head.

[0051] In the golf club head of this embodiment, the thickness of the face member 36 is greater by 0.1 mm than the thickness of the peripheral portion of the face opening portion for the head main body 34.
Also, in the golf club head of this embodiment, the face main body 34 and the face member 36 are welded by plasma welding while a gap between them is filled up with another metal material (specifically a wire rod having a diameter of 1.5 mm and made of SUS630, like the head main body 34 and the face member 36).

THIRD EMBODIMENT

FIG. 6 is a perspective view showing a golf club head according to a third embodiment of the invention. The golf club head of this embodiment is formed into the iron type golf club head.

The golf club head of this embodiment includes a head main body 52 (cast member of SUS630) having a face opening portion (not shown) on a face side 50 and a face member 54 (rolled member of SUS630) for closing the face opening portion. FIG. 6 shows a state where the head main body 52 and the face member 54 are fixed together.

In the golf club head of this embodiment, when the face member 54 is fixed to a peripheral portion of the face opening portion for the head main body 52, a lower edge 56 of the face member 54 constitutes a part of the sole portion for the golf club head and a leading edge 58 of the face member 54 constitutes a part of the toe portion for the golf club head.

In the golf club head of this embodiment, the thickness of the face member 54 is greater by 0.1 mm than the thickness of the peripheral portion of the face opening portion for the head main body 52.

Also, in the golf club head of this embodiment, the face main body 52 and the face member 54 are welded by laser welding while a gap between them is filled up with another metal material (specifically a wire rod having a diameter of 1.5 mm and made of SUS630, like the head main body 52 and the face member 54).

FOURTH EMBODIMENT

FIG. 7 is an exploded perspective view showing a golf club head according to a fourth embodiment of the invention. The golf club head of this embodiment is formed into the wood type golf club head having a hollow portion, or the composite club head made of fiber reinforced resin and metal having a metallic portion at least on the sole portion.

The golf club head of this embodiment includes a head main body 66 (cast member of 6-4Ti) having a face opening portion 62 on a face side 60 and a crown-side opening portion 64 in most of a crown portion and a side portion, a face member 68 (rolled member of SP7000) for closing the face opening portion 62, and a crown-side member 70 made of carbon fiber reinforced resin (CFRP) for closing the crown-side opening portion 64.

In the golf club head of this embodiment, an upper edge of the face opening portion 62 and an upper edge of the face member 68 extend to the crown portion. Accordingly, when the face member 68 is fixed to a peripheral portion of the face opening portion 62 for the head main body 66, an upper edge 72 of the face member 68 constitutes a part of the crown portion for the golf club head.

In the golf club head of this embodiment, the thickness of the face member 68 is greater by 0.1 mm than the thickness of the peripheral portion of the face opening portion for the head main body 66.

Also, in the golf club head of this embodiment, the face main body 66 and the face member 68 are welded by electron beam welding while a gap between them is filled up with another metal material (specifically a wire rod having a diameter of 1.5 mm and made of 6-4Ti, like the head main body 66). Also, the head main body 66 and the crown-side member 70 are fixed by adhesive.

With the golf club head and its manufacturing method according to the invention, since a gap between the metallic members with different thickness is filled up with another metal material, it is unnecessary to machine in advance the metallic members precisely so as not to cause a gap between the metallic members at the time of welding, and the cost for machining the metallic members is reduced. Though a gap between the metallic members with different thickness is filled up with another metal material, there is no sink in the weld zone by plasma welding, laser welding or electronic beam welding, whereby the weight control for the golf club head is relatively easy.

What is claimed is:

1. A golf club head comprising:

   a first metallic member;

   a second metallic member having different thickness from the first metallic member; and

   a part where the first and second metallic members are welded by plasma welding, laser welding or electron beam welding, wherein a gap between the first and second metallic members is filled up with another metal material besides the first and second metallic members.

2. The golf club head according to claim 1,

   wherein the first and second metallic members are a combination of cast member and forged member, a combination of cast member and press-formed member, or a combination of forged member and press-formed member.

3. The golf club head according to claim 1,

   wherein the part where the first and second metallic members are welded by plasma welding, laser welding or electron beam welding extends across at least two sections selected from a face, a sole, a crown, a toe, a heel, a side, a top blade and a hosel.

4. The golf club head according to claim 1,

   wherein the golf club head is a wood type golf club head having a hollow portion.

5. The golf club head according to claim 1,

   wherein the golf club head is an iron type golf club head.

6. The golf club head according to claim 1,

   wherein the golf club head is a composite golf club head made of fiber reinforced resin and metal.

7. A manufacturing method of a golf club head, which includes a first metallic member, and a second metallic member having different thickness from the first metallic member, the manufacturing method comprising:
welding the first and second metallic members by plasma welding, laser welding or electron beam welding; and filling up a gap between the first and second metallic members with another metal material besides the first and second metallic members.

8. The manufacturing method of a golf club head according to claim 7, wherein the first and second metallic members are a combination of cast member and forged member, a combination of cast member and press-formed member, or a combination of forged member and press-formed member.

9. The manufacturing method of a golf club head according to claim 7, wherein the part where the first and second metallic members are welded by plasma welding, laser welding or electron beam welding extends across at least two sections selected from a face, a sole, a crown, a toe, a heel, a side, a top blade and a hosel.

10. The manufacturing method of a golf club head according to claim 7, wherein the golf club head is a wood type golf club head having a hollow portion.

11. The manufacturing method of a golf club head according to claim 7, wherein the golf club head is an iron type golf club head.

12. The manufacturing method of a golf club head according to claim 7, wherein the golf club head is a composite golf club head made of fiber reinforced resin and metal.

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