

Description

The present invention relates to an alloy for use in the repair of and in the manufacture of turbine components.

More specifically, the alloy of the present invention is suitable for the repair of and in the manufacture of gas turbine engine components, which in use are exposed to direct contact with exhaust gases from the combustion apparatus of such an engine.

As the need arises for gas turbine engines to operate at higher operating temperatures, so a need arises for the developing of new alloys of metal which will withstand the increase in temperature.

French specification 2,296,491 discloses the use of two alloys combined in powder form, one of which is identical with the alloy of an article to be repaired, and the other of which approximates the article alloy. The article may be repaired by the combination. A drawback is the excessive time scale needed, to effect the repair i.e. 24 to 48 hours.

US specification 4,507,264 teaches a brazing alloy for the repair of gas turbine components, which alloy is cobalt free so as to allegedly enable its use in powder form.

The present invention seeks to provide an alloy which by itself or in combination with other alloys, is suitable for use in the repair or manufacture of components the material of which is a nickel based superalloy.

According to the present invention an alloy suitable for use in the repair and/or manufacture of nickel based superalloy components comprises, by weight percentage

Al	Co	Cr	Fe	Hf	Ta	Ti	W	B	Y	Ni
2	9	8	-	1.0	1.0	1.25	6	2.8	0.001	Balance
3	11	10	1.8	1.5	1.5	1.75	8	3.4	0.02	

The invention will now be described by way of example, and with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view of a gas turbine engine turbine blade.

Figure 2 is a part view of the blade of Figure 1.

Referring to Figure 1. A gas turbine engine turbine blade 10 is made from a superalloy eg MarM002 which is the trade name for one such alloy. The blade 10 has cooling passages 12 and 14 therein which extend within the length of the aerofoil portion 11 and join a plenum chamber 16 at the top of the blade 10.

In order to simplify manufacture, the plenum chamber 16 is formed by casting a hole in the shroud 18 of the blade 10 and then brazing a cap 20 thereover, to seal it against egress of cooling air to atmosphere during operation of the blade 10 in an engine.

The cap 20 is manufactured from material which is identical with that of the blade 10. The braze material however, by weight percentage, is that of the present invention, as follows:

Al	Co	Cr	Fe	Hf	Ta	Ti	W	B	Y	Ni
2	9	8	-	1.0	1.0	1.25	6	2.8	0.001	Balance
3	11	10	1.8	1.5	1.5	1.75	8	3.4	0.02	

The alloy of the present invention, for the purpose of brazing the cap 20, will be produced in foil form (not shown), though if it is so desired, it could be applied as a powder layer, to the cap.

In the present example, brazing is achieved by heating the blade 10, complete with the cap 20 and foil in a vacuum to a temperature of 1190 °C and holding that temperature for three hours. The temperature is then allowed to drop to 1000 ° and thereafter, the assembly is rapidly quenched by a flow of inert gas.

Referring now to Figure 2. The blade 10 is provided with seal fins 22, 24 which are well known features and consequently will not be described in detail. Suffice it to say that the fin 22 is depicted as having had machining marks obviated, using the alloy of the present invention, at the position indicated by the numeral 26. Further, the tip of the seal fin 24 has had wear damage repaired by using the alloy of the present invention at the position indicated by the numeral 28.

In both cases, the alloy of the present invention was reduced to a powder, a quantity of which was then bound by an acrylic or water based binder of known kind. Thereafter the resulting paste was built up in the damaged portions of the blade 10 and the resulting assembly placed in a vacuum and sinter brazed to a

solid form and thereafter machined to a finished profile. This method is effected at a temperature which is not so high as to melt the alloy of the invention and, as a technique, is well known.

Further use to which the alloy of the present invention can be put is as a substitute, again in powder form, for the high melting point braze material which is disclosed in granted British patent 2,107,628 and which is sold under the trade name MICROBRAZ 30.

Mechanical tests performed on a component which has been repaired as described hereinbefore with reference to both sinter brazing and brazing with foil, have shown that the strength characteristics of the component per se, are matched by the alloy of the present invention.

Claims

1. An alloy suitable for use in the repair and/or manufacture of a nickel based superalloy component comprising, by weight percentage,

Al	Co	Cr	Fe	Hf	Ta	Ti	W	B	Y	Ni
2	9	8	-	1.0	1.0	1.25	6	2.8	0.001	Balance
3	11	10	1.8	1.5	1.5	1.75	8	3.4	0.02	

2. A method of using the alloy claimed in claim 1 in the manufacture of a superalloy component comprising the steps of forming a thin foil therefrom, placing the foil between two components and heating and then cooling the whole to effect brazing of the two components together,

3. The method of claim 2 wherein said whole is heated in a vacuum to 1190 °C, cooled to 1000 °C in said vacuum and then quenched rapidly relative to the first said cooling, by a flow of inert gas.

4. A method of using the alloy claimed in claim 1 to effect a repair to a superalloy component comprising the steps of reducing the alloy to a powder, binding the powder with an acrylic or water based binder, applying the resulting paste to the damaged area of the component, then heating the whole in vacuum so as to sinter braze the paste to the component, cooling the whole firstly in said vacuum and finally by exposure to a flow of inert gas and thereafter machining the sinter brazed alloy to the described profile of the component.

Patentansprüche

1. Legierung, geeignet zur Benutzung bei der Reparatur und/oder Herstellung eines Bauteils aus einer auf Nickel basierenden Superlegierung, welche die folgenden Bestandteile in Gewichtsprozenten aufweist:

Al	Co	Cr	Fe	Hf	Ta	Ti	W	B	Y	Ni
2	9	8	-	1,0	1,0	1,25	6	2,8	0,001	Rest
3	11	10	1,8	1,5	1,5	1,75	8	3,4	0,02	

2. Verfahren zur Anwendung der Legierung gemäß Anspruch 1 bei der Herstellung eines Bauteils aus einer Superlegierung, welches die folgenden Schritte umfaßt: es wird aus der Legierung eine dünne Folie hergestellt, es wird die Folie zwischen zwei Bauteile gelegt und erhitzt und dann läßt man das Ganze abkühlen, um eine Hartverlötung der beiden Bauteile miteinander zu bewirken.

3. Verfahren nach Anspruch 2, bei welchem das Ganze unter Vakuum auf 1190 °C erhitzt, auf 1000 °C im Vakuum abgekühlt und dann schnell relativ zu der ersten Abkühlung durch einen Inertgasstrom abgeschreckt wird.

4. Verfahren zur Anwendung der Legierung gemäß Anspruch 1 zur Reparatur eines Bauteils aus einer Superlegierung, welches die folgenden Schritte umfaßt: es wird die Legierung zu einem Pulver verarbeitet, es wird das Pulver mit einem auf Acryl oder Wasser basierenden Binder gebunden, es wird



solid form and thereafter machined to a finished profile. This method is effected at a temperature which is not so high as to melt the alloy of the invention and, as a technique, is well known.

Further use to which the alloy of the present invention can be put is as a substitute, again in powder form, for the high melting point braze material which is disclosed in granted British patent 2,107,628 and which is sold under the trade name NICROBRAZ 30.

Mechanical tests performed on a component which has been repaired as described hereinbefore with reference to both sinter brazing and brazing with foil, have shown that the strength characteristics of the component per se, are matched by the alloy of the present invention.

10 Claims

1. An alloy suitable for use in the repair and/or manufacture of a nickel based superalloy component comprising, by weight percentage,

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2. A method of using the alloy claimed in claim 1 in the manufacture of a superalloy component comprising the steps of forming a thin foil therefrom, placing the foil between two components and heating and then cooling the whole to effect brazing of the two components together,

3. The method of claim 2 wherein said whole is heated in a vacuum to 1190 °C, cooled to 1000 °C in said vacuum and then quenched rapidly relative to the first said cooling, by a flow of inert gas.

4. A method of using the alloy claimed in claim 1 to effect a repair to a superalloy component comprising the steps of reducing the alloy to a powder, binding the powder with an acrylic or water based binder, applying the resulting paste to the damaged area of the component, then heating the whole in vacuum so as to sinter braze the paste to the component, cooling the whole firstly in said vacuum and finally by exposure to a flow of inert gas and thereafter machining the sinter brazed alloy to the described profile of the component.

35 Patentansprüche

1. Legierung, geeignet zur Benutzung bei der Reparatur und/oder Herstellung eines Bauteils aus einer auf Nickel basierenden Superlegierung, welche die folgenden Bestandteile in Gewichtsprozenten aufweist:

Al	Co	Cr	Fe	Hf	Ta	Ti	W	B	Y	Ni
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3	11	10	1,8	1,5	1,5	1,75	8	3,4	0,02	

2. Verfahren zur Anwendung der Legierung gemäß Anspruch 1 bei der Herstellung eines Bauteils aus einer Superlegierung, welches die folgenden Schritte umfaßt: es wird aus der Legierung eine dünne Folie hergestellt, es wird die Folie zwischen zwei Bauteile gelegt und erhitzt und dann läßt man das Ganze abkühlen, um eine Hartverlötung der beiden Bauteile miteinander zu bewirken.

3. Verfahren nach Anspruch 2, bei welchem das Ganze unter Vakuum auf 1190 °C erhitzt, auf 1000 °C im Vakuum abgekühlt und dann schnell relativ zu der ersten Abkühlung durch einen Inertgasstrom abgeschreckt wird.

4. Verfahren zur Anwendung der Legierung gemäß Anspruch 1 zur Reparatur eines Bauteils aus einer Superlegierung, welches die folgenden Schritte umfaßt: es wird die Legierung zu einem Pulver verarbeitet, es wird das Pulver mit einem auf Acryl oder Wasser basierenden Binder gebunden, es wird



die sich so ergebende Paste auf den beschädigten Bereich des Bauteils aufgebracht, und es wird das Ganze dann im Vakuum so erhitzt, daß eine Sinterverlötung der Paste mit dem Bauteil erfolgt, es wird das Ganze zunächst im Vakuum abgekühlt und schließlich einem Inertgasstrom ausgesetzt, und danach wird die sinterverlötete Legierung spanabhebend auf das vorgeschriebene Profil des Bauteils verarbeitet.

Revendications

1. Alliage adapté à être utilisé dans la réparation et/ou la fabrication d'une pièce en superalliage à base de nickel, comprenant en pourcentage massique,

Al	Co	Cr	Fe	Hf	Ta	Ti	W	B	Y	Ni
2	9	8	-	1,0	1,0	1,25	6	2,8	0,001	Complément
3	11	10	1,8	1,5	1,5	1,75	8	3,4	0,02	

2. Procédé d'utilisation de l'alliage revendiqué dans la revendication 1, dans la fabrication d'une pièce en superalliage, comprenant les étapes de former une feuille fine de l'alliage, placer la feuille entre deux pièces, chauffer et ensuite refroidir l'ensemble pour effectuer un brasage des deux ensembles.
3. Procédé selon la revendication 2, dans lequel ledit ensemble est chauffé dans un vide à 1 190 °C, refroidi à 1 000 °C dans ledit vide, et ensuite trempé rapidement par rapport audit premier refroidissement, par un écoulement de gaz inerte.
4. Procédé d'utilisation de l'alliage revendiqué dans la revendication 1 pour effectuer une réparation d'une pièce en superalliage, comprenant les étapes de réduire l'alliage en poudre, lier la poudre avec un liant à base d'acrylique ou d'eau, appliquer la pâte résultante sur la zone endommagée de la pièce, puis chauffer l'ensemble dans un vide de façon à braser par frittage la pâte sur la pièce, refroidir l'ensemble d'abord dans ledit vide et finalement par exposition à un écoulement de gaz interne, et ensuite usiner l'alliage brasé par frittage, au profil décrit du composant.