A mounted diamond component comprising: a diamond component bonded to a mounting component via a bond, wherein the bond comprises a layer of carbide forming metal adhered to the diamond component, a barrier layer disposed over the carbide forming metal layer, and a layer of gold disposed over the barrier layer, wherein the layer of carbide forming metal has a thickness in a range 1 to 100 nm, wherein the barrier layer has a thickness in a range 10 to 200 nm, wherein the layer of gold has a thickness in a range 0.5 to 40 micrometres, wherein the bond has a shear stress in a range 2 to 50 kg/mm² and a thermal conductivity in a range 50 to 500 W/mK, wherein the layer of gold is formed of two fused layers of gold which form the bonding between the diamond component and the mounting component and wherein the bond does not comprise a metallic solder or braze bond between the layer of gold and the mounting component.
MOUNTED DIAMOND COMPONENTS AND METHODS OF FABRICATING THE SAME

Field of Invention

The present invention relates to methods of bonding a diamond component to a mounting component and to the resultant mounted diamond components. The mounted diamond components have uses such as in high power optical applications and as thermal substrates.

Background of Invention

The use of diamond for applications such as thermal substrates and optical window components is known. Diamond material is useful as an optical component as it has low absorption. Diamond material has the additional advantage over other possible window materials in that it is mechanically strong, inert, and biocompatible. For example, the inertness of diamond material makes it an excellent choice for use in reactive chemical environments where other optical window materials would not be suitable. Further still, diamond material has very high thermal conductivity and a low thermal expansion coefficient. As such, diamond material is useful for use as an optical component in high energy beam applications where the component will tend to be heated. The diamond material will rapidly conduct away heat to cool areas where heating occurs so as to prevent heat build-up at a particular point, e.g. where a high energy beam passes through the material. To the extent that the material is heated, the low thermal expansion coefficient of diamond material ensures that the component does not unduly deform which may cause optical and/or mechanical problems in use.

One problem with using diamond as a window material is that the diamond window has a tendency to de-bond from the mounting component to which it is attached, for example due to chemical and/or thermal conditions.

The present inventors have found that the vast majority of known bonding techniques are unsuitable for reliably bonding diamond material. This is largely due to the extreme rigidity of diamond material and the very low thermal expansion coefficient
of diamond material which causes thermal expansion mismatch between the diamond material, the adhesive material used to bond the diamond material, and the material of the mounting component to which the diamond component is bonded. During use, changes in temperature cause strain build up in the adhesive material due to thermal expansion or contraction and failure of the adhesive material results.

In addition to the above described issues relating to rigidity and thermal expansion coefficient mismatches, bonding of diamond material is also problematic due to the extreme chemical inertness of the diamond material which causes difficulties in forming strong chemical bonds with a surface of the diamond material.

As such, the inventors have recognized that bonding diamond material is a somewhat unique problem due to the extreme properties of diamond material and much effort has been put into the identification of bonding techniques which can reliably bond diamond components without failure in use due to changes in temperature. This is particularly problematic as diamond material is often selected for a particular use when thermal management is a problem. This is due to diamonds extremely high thermal conductivity, low electrical conductivity, and low thermal expansion coefficient allowing the material to effectively remove heat from electronic components or high energy optical beams while retaining dimensional stability. However, diamond's apparent advantages in this regard have also been found to be problematic in that adhesive material which is adhered to the diamond material, and mounting components to which the diamond material is adhered, do not share diamond's extreme thermal properties and thus can fail due to thermal mismatches between the different materials. The problem is further exacerbated by the fact that a thin, thermally conductive bond is desirable to allow heat to efficiently flow out of the diamond component and into a mounting component which may be cooled, e.g. by a fluid, and/or mounted to a heat sink for removal of heat from a device configuration. Such thin, thermally conductive bonds tend to have less capability to allow for thermal mismatches between the diamond component and the mounting component resulting in thermal stress induced failure.

A number of different diamond bonding methods have been suggested in the prior art for addressing one or more of the aforementioned problems. Several of the present
proprietary's own prior art disclosures relating to bonding of diamond components are discussed below.

WO 01/61399 is directed to pressure bonding of a diamond window where the edges of the window and mount are sloped. This document discloses gold coating a sloped edge of a diamond window, gold coating a complimentary sloped edge of a window mounting component, pressing the two together, and heating to a bonding temp of around 500°C. Pressure between the diamond component and the mounting component is generated by shrinkage of the metal around the diamond window on cooling such that the resultant mounting configuration exerts a relatively high loading force on the diamond window in a direction which is in-plane with the diamond window component. This bonding technique is suitable for relatively small diamond windows, such as single crystal diamond windows, which are sufficiently strong to survive the constant high pressure exerted on the rim of the diamond window in such a mounting configuration without bulging and breaking.

WO2012/013687 is directed to a method of mounting a diamond window into a tubular component for a laser tool. The component comprises a tubular body defining an internal channel and an aperture and a diamond window disposed across the aperture and bonded to the tubular body around the aperture. The tubular body comprises a material having a coefficient of linear thermal expansion \( a \) of \( 14 \times 10^{-6} \) K\(^{-1}\) or less at 20°C and a thermal conductivity of 60 Wm\(^{-1}\)K\(^{-1}\) or more at 20°C. Providing a tubular body having a relatively low thermal expansion coefficient and a relatively high thermal conductivity aids in minimizing thermally induced stress and failure at the bond between the diamond window and the tubular body. It is further described that the diamond window can be provided with a metallization coating at the bonding regions and that the metallization coating may comprise a layer of carbide forming material (e.g. titanium) bonded to the diamond window, an inert barrier layer(e.g. platinum), and a metal layer (e.g. gold) soldered or brazed to the tubular body.

WO2012/034926 (which is equivalent to GB2483768) is also directed to a method of mounting a diamond window into a tubular component. In this case, the component
comprises a chemically inert tubular body (e.g. made of hastelloy C-276), a mounting ring (e.g. made of molybdenum), and a diamond window. The diamond window is joined to the mounting ring using an inert metal braze such as a gold/tantalum braze. The diamond window is brazed at a temperature of 1240°C. The tubular body comprises an internally tapered end portion and the mounting ring is press-fit into the tapered end portion. This document also discloses the use of a metallization coating on the diamond window between the diamond window and the inert metal braze join. The metallization coating comprises a layer of a carbide forming metal and the metallization coating further comprise an inert metal barrier layer between the layer of carbide forming metal and the braze join.

WO 01/31082 discloses a diamond heat spreader bonded between a copper heat sink and to a silicon microprocessor. The diamond heat spreader has major opposed surfaces prepared with a series of metals applied by sputtering: 20 nm of titanium; 100 nm of platinum; and 1 micrometre of gold. One of the major faces of the diamond heat spreader is bonded to a copper heat sink using a metallic solder bond such as a 63/37 tin/lead solder. The other side of the diamond heat spreader is bonded to a silicon microprocessor also using a metallic solder such as a gold/tin eutectic metallic solder.

In WO2012/013687, WO2012/034926, and WO 01/31082 the bond between the diamond component and the component to which the diamond is mounted includes a titanium/platinum/gold metallization coating on the diamond component and also a metallic solder or braze bond between the gold and the component to which the diamond is mounted.

Following on from the above, the present proprietors have revisited the problem of mounting and bonding diamond components with the aim of providing a bonding methodology which has improved functional performance in terms of combining mechanical robustness with improved thermal conductivity. In particular, certain embodiments of the present invention seek to provide mounted diamond window components suitable for very high power laser applications where previous bonding solutions do not provide the desired levels of performance in terms of mechanical robustness and high thermal conductivity.
Summary of Invention

The present inventors have investigated different bonding solutions for diamond components in terms of different materials, different layer thicknesses, different bonding temperatures, and different applied pressures during bonding. In light of this investigation the present inventors have identified an optimum combination of bonding parameters for achieving improved functional performance in terms of combining mechanical robustness with improved thermal conductivity for very high power laser applications where previous bonding solutions do not provide the desired level of performance in terms of mechanical robustness and high thermal conductivity. The bonding methodology can be applied in high power laser applications or in other high power applications such as high power electronics.

One aspect of the present invention provides a mounted diamond component comprising:

- a diamond component bonded to a mounting component via a bond,
  wherein the bond comprises a layer of carbide forming metal adhered to the diamond component, a barrier layer disposed over the carbide forming metal layer, and a layer of gold disposed over the barrier layer,
  wherein the layer of carbide forming metal has a thickness in a range 1 to 100 nm,
  wherein the barrier layer has a thickness in a range 10 to 200 nm,
  wherein the layer of gold has a thickness in a range 0.5 to 40 micrometres,
  wherein the bond has a shear stress in a range 5 to 50 kg/mm² and a thermal conductivity in a range 50 to 500 W/mK,
  wherein the layer of gold is formed of two fused layers of gold which form the bonding between the diamond component and the mounting component and wherein the bond does not comprise a metallic solder or braze bond between the layer of gold and the mounting component.

Another aspect of the present invention provides a method fabricating a mounted diamond component, the method comprising:

- coating a portion of the diamond component with a layer of gold;
- coating a portion of the mounting component with a layer of gold;
pressing the diamond component and the mounting component together such that the layers of gold contact each other, wherein an applied pressure lies in a range 1 to 100 kg/mm²; and

heating the layers of gold while pressing the layers together such that the gold layers bond together, the applied heat lying in a temperature range 25 to 1000°C,

wherein the diamond component is metalized with a carbide forming metal layer and a barrier layer and the layer of gold applied to the diamond component is applied over the metallization;

wherein the carbide forming metal layer has a thickness in a range 1 to 100 nm,

wherein the barrier layer has a thickness in a range 10 to 200 nm,

wherein a total thickness of the two layers of gold after coating and prior to bonding lies in a range 0.5 to 50 micrometres; and

wherein a total thickness of the bonded gold layers after bonding lies in a range 0.5 to 40 micrometres.

It should be noted that the bonding methodology as described above does not involve soldering or brazing a metallized diamond component to a mounting component. Rather, two layers of gold are fused together to form the bonding between the diamond component and the mounting component. The resultant layer of gold in the bond is thus formed of two fused layers of gold which form the bonding between the diamond component and the mounting component and the bond does not comprise a metallic solder or braze bond between the layer of gold and the mounting component. The layer of gold may be directly bonded to the mounting component such that the bond consists of only the layer of carbide forming metal, the barrier layer, and the layer of gold. Alternatively, if the mounting component is formed of a material which does not adhere well to gold, then a further metal coating layer may be provided on the mounting component prior to coating with gold. In such a configuration, the final bond will include the layer of gold which is bonded to the mounting component via a metal coating on the mounting component which is not a metallic solder or braze bond. By negating the requirement for a metallic solder or braze, the entire thickness of the bond can be less than 50 micrometres, 40 micrometres, 30 micrometres, or 20 micrometres. Furthermore, by negating the requirement for a metallic solder or braze, the bond has a very high thermal conductivity in a range 50 to 500 W/mK. Further
still, by careful optimization of the layer thicknesses and bonding conditions, the bond 
has a high shear stress in a range 5 to 50 kg/mm² without the use of a metallic solder 
or braze join thus providing a combination of thermal performance and mechanical 
robustness which is not achieved by prior art configurations.

**Brief Description of the Drawings**

For a better understanding of the present invention and to show how the same may be 
carried into effect, embodiments of the present invention will now be described by 
way of example only with reference to the accompanying drawings, in which:

Figure 1 illustrates a cross-sectional view of a mounted diamond component 
according to an embodiment of the present invention;

Figure 2 illustrates a plan view of a mounted diamond component according to an 
embodiment of the present invention;

Figure 3 illustrates the method steps used to fabricate the mounted diamond 
component as illustrated in Figures 1 and 2; and

Figure 4 illustrates a cross-sectional view of a mounted diamond component 
according to another embodiment of the present invention.

**Detailed Description of Certain Embodiments**

Figure 1 illustrates a cross-sectional view of a mounted diamond component 
according to an embodiment of the present invention. The mounted diamond 
component comprises a diamond component 2 bonded to a mounting component 4 via 
a bond 6. The bond 6 comprises a layer of carbide forming metal 8 adhered to the 
diamond component 4, a barrier layer 10, and a layer of gold 12 which is bonded to 
the mounting component 4.
The diamond component 2 is in the form of a plate having two opposed major faces and a side edge, and the bond 6 is disposed on at least one of the major faces of the diamond component 2. The bond 6 is disposed on a peripheral region of at least one of the major faces of the diamond component 2 to form a continuous frame which defines a central window of the diamond component. The diamond component has at least one linear dimension of at least 20 mm, 40 mm, 60 mm, 80 mm, 100 mm, 120 mm, or 140 mm. Furthermore, the diamond component has a thickness in a range 0.2 to 2 mm or 0.5 to 2 mm.

Diamond material quality and surface finish can be important for bonding in certain applications. For example, the surface finish can have an effect on the bonding strength and a certain material quality can be required, e.g. for optical and/or thermal performance in combination with the optimized bond. Both flatness (PV) and surface roughness (Ra) are important parameters. Flatness should be in a range of 0.1-10 fringes (at 632nm), more typically between 0.2 and 4 fringes. Surface roughness (Ra) should lie between 0.1 and 20 nm, typically between 2 and 10 nm.

The mounting component 4 comprises an aperture 16 and a window seat 18 disposed around the aperture 16 and the bond 6 is disposed in the window seat 18 around the aperture 16. The mounting component 4 may be formed of a metal or other material and may also comprise a fluid channel 14 for coolant. Example materials for the mounting component including: CVD diamond; metals such as Cu, Mo, Al, Invar, Kovar, and stainless steel; and ceramics such as WC, SiC, SiN, and A1N.

Figure 2 illustrates a plan view of the mounted diamond component illustrated in Figure 1 including the diamond component 2 bonded to a mounting component 4 via a bond 6 in the window seat 18 of the mounting component 4.

The bond 6 as illustrated in Figure 1 comprises a three layer structure including a layer of a carbide forming material such as titanium, an inert barrier layer such as platinum, and a gold layer which provides the bulk of the bond. The titanium (or another carbide forming metal such as tantalum) provides a good bond with the diamond forming titanium carbide at an interface with the diamond. The gold
provides a good bond to the mounting component. The platinum functions as an inert barrier between the gold and titanium which otherwise can adversely react.

Thus far, the bonding configuration is similar to those described in the prior art cited in the background section of this specification. The present bonding method and resultant bonding structure differ in terms of the layer thicknesses and in terms of the pressure and temperature used to form the bond. In this regard, the present inventors have investigated different layer thicknesses, different bonding temperatures, and different applied pressures during bonding. In light of this investigation the present inventors have identified an optimum combination of bonding parameters for achieving improved functional performance in terms of combining mechanical robustness with improved thermal conductivity for very high power laser applications where previous bonding solutions do not provide the desired level of performance in terms of mechanical robustness and high thermal conductivity.

The layer of carbide forming metal 8 has a thickness in a range 1 to 100 nm, 20 to 80 nm, 40 to 80 nm, or 40 to 60 nm. The layer of gold 12 has a thickness in a range 0.5 to 40 micrometres, 1 to 20 micrometres, or 2 to 15 micrometres. The barrier layer 10 disposed between the carbide forming metal layer 8 and the gold layer 12 has a thickness in a range 10 to 200 nm or 60 to 160 nm and may be formed of platinum.

Providing the above structural features and using the fabrication method as described below, the bond 6 has a shear stress in a range 2 to 50 kg/mm², 2 to 20 kg/mm², or 5 to 20 kg/mm² and a thermal conductivity in a range 50 to 500 W/mK or 70 to 300 W/mK. For example, in tests comprising Au sputter coated A1N on A1N, shear strengths of 80 N/mm² have been achieved using a bonding temperature of 325°C, a bonding pressure of 400 N/mm², and a bonding time of 30 mins, with an Au layer thickness of 2 microns, a surface roughness Ra < 10 nm, and a surface flatness PV < 2 fringes.

Figure 3 illustrates the method steps used to fabricate the mounted diamond component as illustrated in Figures 1 and 2.
In step 3(A) a diamond component 2 is metallized to provide a carbide forming metal layer 8 having a thickness in a range 1 to 100 nm, a barrier layer 10 having a thickness in a range 10 to 200 nm, and a gold layer 20.

In step 3(B) the mounting component 4 is coated with a layer of gold 22. The total thickness of the gold layer 20 on the diamond component and the gold layer 22 on the mounting component lies in a range 0.5 to 50 micrometres. One or both of the layers of gold may be deposited using a sputtering process. Furthermore, one or both of the layers of gold may have an individual layer thickness after coating and prior to bonding which lies in a range 0.5 to 30 micrometres or 1 to 15 micrometres.

In step 3(C) the diamond component 2 and the mounting component 4 are pressed together such that the layers of gold 20, 22 contact each other. An applied pressure lies in a range 1 to 100 kg/mm$^2$ or 2 to 50 Kg/mm$^2$. The layers of gold 20, 22 are heated while pressing the layers together such that the gold layers bond together, the applied heat lying in a temperature range 25 to 1000°C, 25 to 500°C, or 50 to 500°C. The bonding time during which heating and pressure are applied may lie in a range 1 to 120 minutes, more specifically between 10 and 60 minutes. The gold layers 20, 22 fuse to form a single gold layer 12 as illustrated in Figure 3(D). A total thickness of the bonded gold layers after bonding lies in a range 0.5 to 40 micrometres.

The size of the bond or the bonding area can also be important to provide sufficient mechanical strength and thermal contact between the diamond component and the mounting component while providing sufficient free aperture for window applications. A bonding contact area may lie in a range 0.5% - 20%, more typically between 2% and 7%, of a surface area of the diamond component on which the bond is disposed. For example, for a typical diamond optical window a rim of metal bonding 1 to 2 mm in width is provided between the diamond optical window and the window mount.

In the illustrated embodiment, the diamond component is in the form of a plate having two opposed major faces and a side edge. The portion of the diamond component to which the bonding layers are applied is on at least one of the major faces of the diamond component and the applied pressure is in a direction perpendicular to the
major faces of the plate. While Figures 1 to 3 illustrate embodiments in which a portion of only one of the major faces of the diamond component is bonded to a mounting component, it is also envisaged that a portion of both major faces of the diamond component are bonded to a mounting component. Such an arrangement is illustrated in Figure 4 and comprises a diamond component 40 sandwiched between two mounting components 42, 44. A portion of each of the major faces of the diamond component 40 is provided with a three layer bond including a carbide forming metal layer 46 having a thickness in a range 1 to 100 nm, a barrier layer 48 having a thickness in a range 10 to 200 nm, and a gold layer 50 having a layer thickness in a range 0.5 to 40 micrometres. Each of the mounting components 42, 44 may be provide with a fluid channel 52 for coolant. Furthermore, the mounting components 42, 44 may be attached or clamped together by, for example, a bolt 54 or other attachment means. Such a sandwich configuration can provide further mechanical and thermal stability and improved heat sinking into the cooled mounting components 42, 44.

The aforementioned mounting configurations differ from the pressure bonding method described in WO 01/61399 which comprises gold coating a sloped edge of a diamond window, gold coating a complimentary sloped edge of a window mounting component, pressing the two together, and heating to a bonding temp of around 500°C. Using that method, pressure between the diamond component and the mounting component is generated by shrinkage of the metal around the diamond window on cooling such that the resultant mounting configuration exerts a relatively high loading force on the diamond window in a direction which is in-plane with the diamond window component. As such, the bonding technique described in WO 01/61399 is only suitable for relatively small diamond windows, such as single crystal diamond windows, which are sufficiently strong to survive the constant high pressure exerted on the rim of the diamond window in such a mounting configuration without bulging and breaking. In contrast, the present mounting configurations are suitable for bonding of large area diamond windows and thermal substrates as the pressure is applied perpendicular to the plane of the plate during bonding and after bonding the mounting component does not exert a high pressure on the edge of the diamond component which could result in bulging and breakage.
It has been found that the ductility of gold under the previously defined temperature and pressure ranges gives an improved contact area between the diamond window component and the mounting component. One key feature is to make the layers sufficiently thick to benefit from the (bulk) ductility of the gold layer but also sufficiently thin to minimize the thermal resistance of the layer. The described bonding method and resultant mounting configuration has been found to be better than those previous utilized and described in prior art documents in terms of thermal performance. As thermal performance is one of the main barriers to next generation high power optical and electronic devices, it is believed that this bonding solution will provide a key enabler for these technologies.

While this invention has been particularly shown and described with reference to embodiments, it will be understood by those skilled in the art that various changes in form and detail may be made without departing from the scope of the invention as defined by the appending claims.
Claims

1. A mounted diamond component comprising:
   a diamond component bonded to a mounting component via a bond,
   wherein the bond comprises a layer of carbide forming metal adhered to the
   diamond component, a barrier layer disposed over the carbide forming metal layer,
   and a layer of gold disposed over the barrier layer,
   wherein the layer of carbide forming metal has a thickness in a range 1 to 100
   nm,
   wherein the barrier layer has a thickness in a range 10 to 200 nm,
   wherein the layer of gold has a thickness in a range 0.5 to 40 micrometres,
   wherein the bond has a shear stress in a range 2 to 50 kg/mm² and a thermal
   conductivity in a range 50 to 500 W/mK,
   wherein the layer of gold is formed of two fused layers of gold which form the
   bonding between the diamond component and the mounting component and wherein
   the bond does not comprise a metallic solder or braze bond between the layer of gold
   and the mounting component.

2. A mounted diamond component according to claim 1, wherein the layer of
gold is directly bonded to the mounting component and the bond consists of only the
layer of carbide forming metal, the barrier layer, and the layer of gold.

3. A mounted diamond component according to claim 1, wherein the layer of
gold is bonded to the mounting component via a metal coating on the mounting
component which is not a metallic solder or braze bond.

4. A mounted diamond component according to any preceding claim, wherein
the entire thickness of the bond is less than 50 micrometres, 40 micrometres, 30
micrometres, or 20 micrometres.

5. A mounted diamond component according to any preceding claim,
   wherein the thickness of the carbide forming metal layer is in a range 20 to 80
   nm, 40 to 80 nm, or 40 to 60 nm.

6. A mounted diamond component according to any preceding claim,
   wherein the thickness of the barrier layer is in a range 60 to 160 nm.

7. A mounted diamond component according to any preceding claim,
wherein the thickness of the gold layer is in a range 1 to 20 micrometres, or 2 to 15 micrometres.

8. A mounted diamond component according to any preceding claim, wherein the shear stress of the bond is in a range 2 to 20 Kg/mm² or 5 to 20 Kg/mm².

9. A mounted diamond component according to any preceding claim, wherein the thermal conductivity of the bond is in a range 70 to 300 W/mK.

10. A mounted diamond component according to any preceding claim, wherein the carbide forming metal is titanium.

11. A mounted diamond component according to any preceding claim, wherein the barrier layer is platinum.

12. A mounted diamond component according to any preceding claim, wherein the diamond component is in the form of a plate having two opposed major faces and a side edge, and wherein the bond is disposed on at least one of the major faces of the diamond component.

13. A mounted diamond component according to claim 12, wherein the bond is disposed on a peripheral region of at least one of the major faces of the diamond component to form a continuous frame which defines a central window of the diamond component.

14. A mounted diamond component according to any preceding claim, wherein the diamond component has at least one linear dimension of at least 20 mm, 40 mm, 60 mm, 80 mm, 100 mm, 120 mm, or 140 mm.

15. A mounted diamond component according to any preceding claim, wherein the diamond component has a thickness in a range 0.2 to 2 mm or 0.5 to 2.0 mm.
16. A mounted diamond component according to any preceding claim, wherein the mounting component comprises an aperture and a window seat disposed around the aperture, and wherein the bond is disposed in the window seat around the aperture.

17. A mounted diamond component according to any preceding claim, wherein the mounting component is formed of a metal material.

18. A mounted diamond component according to any preceding claim, wherein the mounting component comprises a fluid channel for coolant.

19. A method fabricating a mounted diamond component according to any preceding claim, the method comprising:
- coating a portion of the diamond component with a layer of gold;
- coating a portion of the mounting component with a layer of gold;
- pressing the diamond component and the mounting component together such that the layers of gold contact each other, wherein an applied pressure lies in a range 1 to 100 kg/mm²; and
- heating the layers of gold while pressing the layers together such that the gold layers bond together, the applied heat lying in a temperature range 25 to 1000°C;
- wherein the diamond component is metalized with a carbide forming metal layer and a barrier layer and the layer of gold applied to the diamond component is applied over the metallization;
- wherein the carbide forming metal layer has a thickness in a range 1 to 100 nm,
- wherein the barrier layer has a thickness in a range 10 to 200 nm,
- wherein a total thickness of the two layers of gold after coating and prior to bonding lies in a range 0.5 to 50 micrometres; and
- wherein a total thickness of the bonded gold layers after bonding lies in a range 0.5 to 40 micrometres.

20. A method according to claim 19, wherein the applied pressure lies in a range 2 to 50 kg/mm².
21. A method according to claim 19 or 20,
wherein the temperature lies in a range 25 to 500°C or 50 to 500°C.

22. A method according to any one of claims 19 to 21,
wherein one or both of the layers of gold are deposited using a sputtering process.

23. A method according to any one of claims 19 to 22,
wherein one or both of the layers of gold have an individual layer thickness after coating and prior to bonding which lies in a range 0.5 to 30 micrometres or 1 to 18.

24. A method according to any one of claims 19 to 23,
wherein the diamond component is in the form of a plate having two opposed major faces and a side edge,
wherein the portion of the diamond component to which the metallization is applied is on at least one of the major faces of the diamond component, and
wherein the applied pressure is in a direction perpendicular to the major faces of the plate.
INTERNATIONAL SEARCH REPORT

PCT/EP2015/053357

A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B7/00 G02B7/18 H01S3/04
ADD.

According to International Patent Classification (IPC) or both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G02B HOIS A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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* Special categories of cited documents:

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"A" document member of the same patent family

Date of the actual completion of the international search: 30 April 2015

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Name and mailing address of the ISA:
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer: Blau, Gerd
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