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(54) **DRILL BIT BODY WITH MULTIPLE BINDERS**

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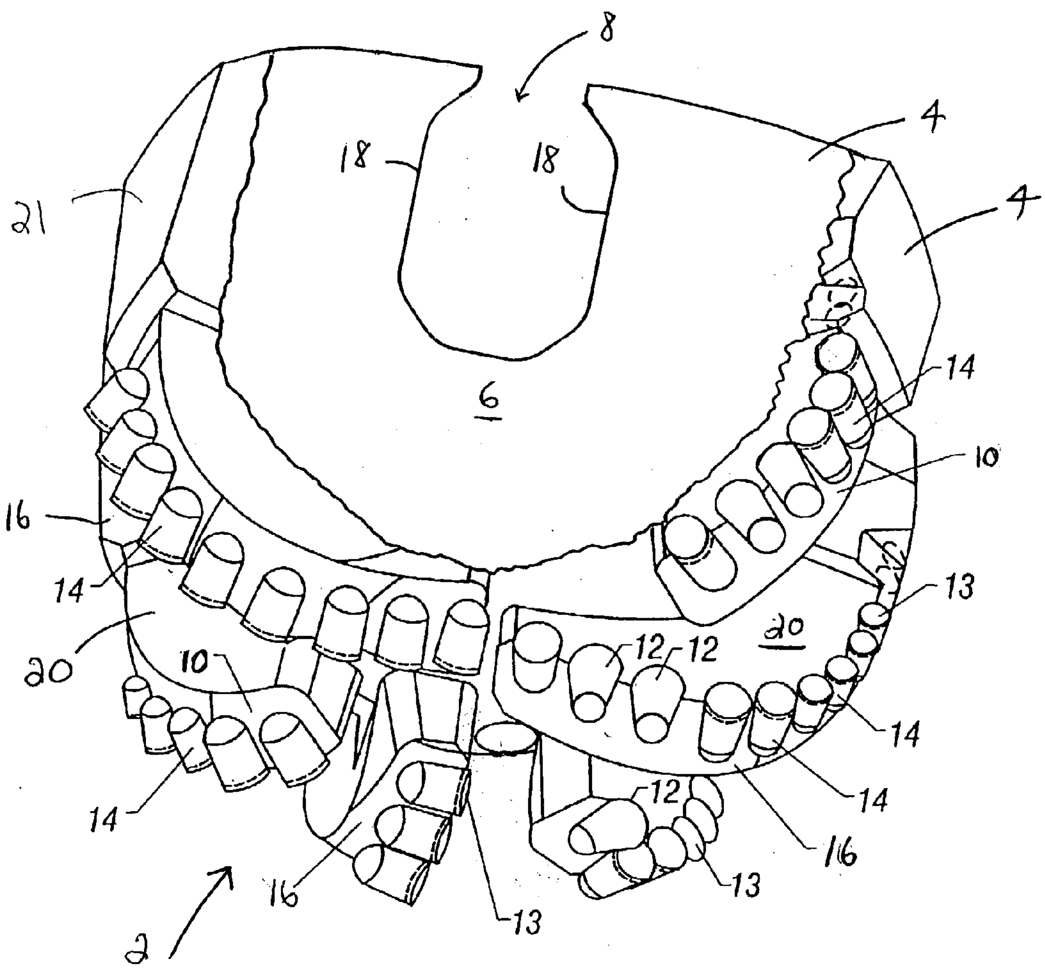
(57) **ABSTRACT**

A structural matrix drill bit body having different binder materials in different spatial locations as well as a method for forming the same, is provided. The different binder materials provide different functional properties to the different spatial locations of the drill bit body. The method for forming such a structural matrix body includes providing a matrix material within a mold, then infiltrating the matrix material with at least two binder materials which provide different functional properties in combination with the material. The arrangement is then heated and the heating process causes the different binder materials to infiltrate different spatial locations of the drill bit body.



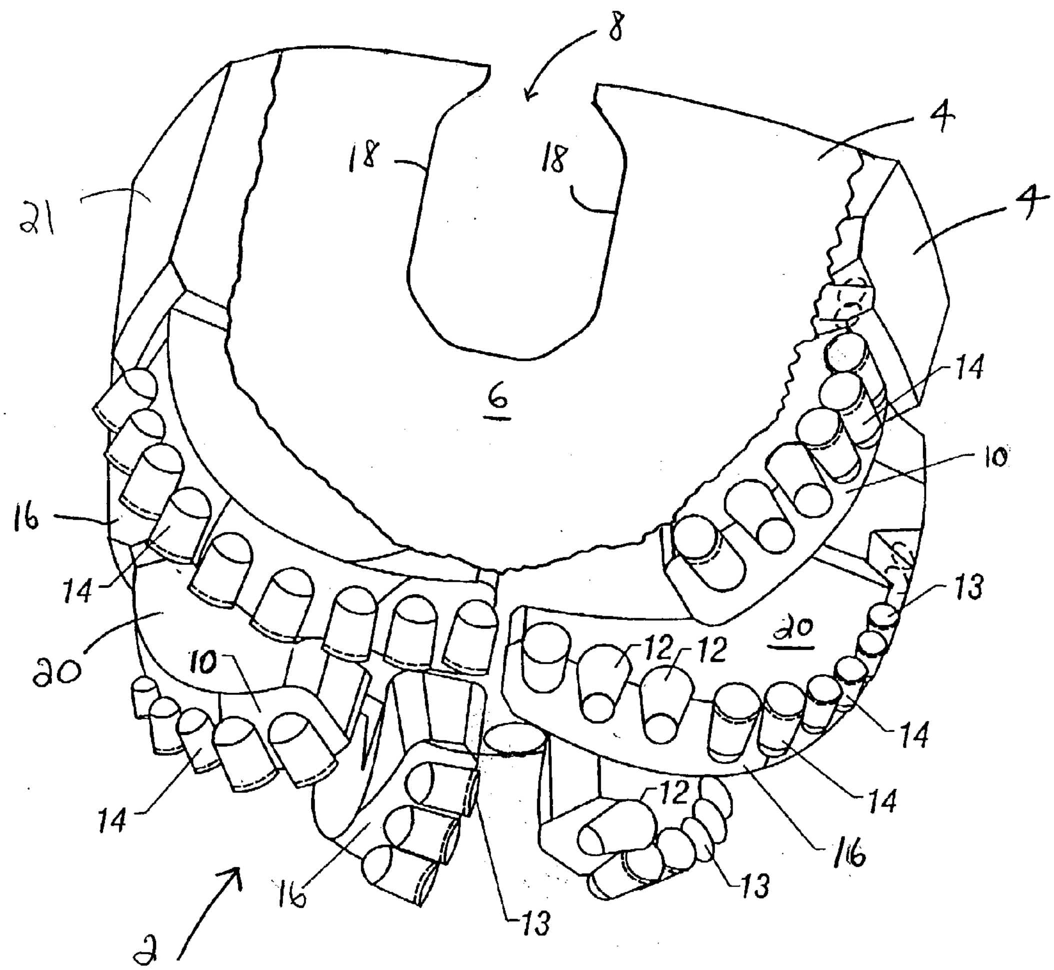


Figure 1

FIG. 2

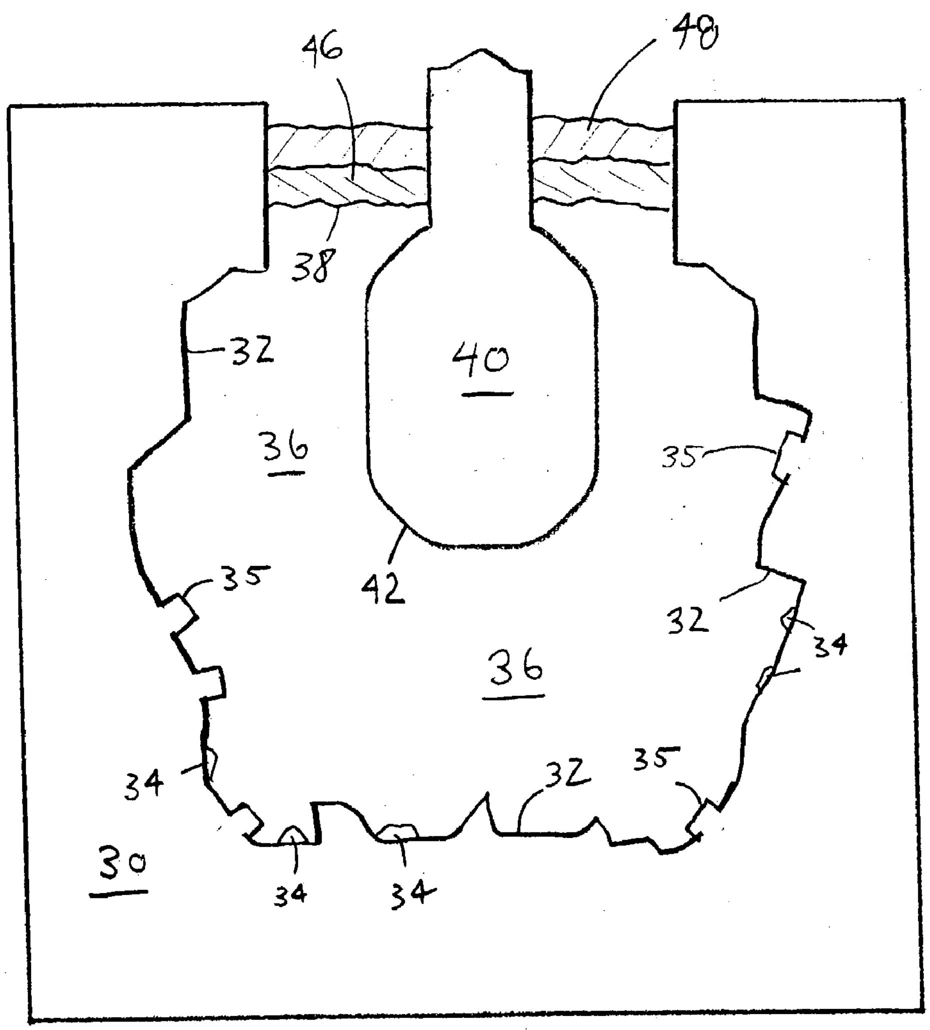


FIG. 3

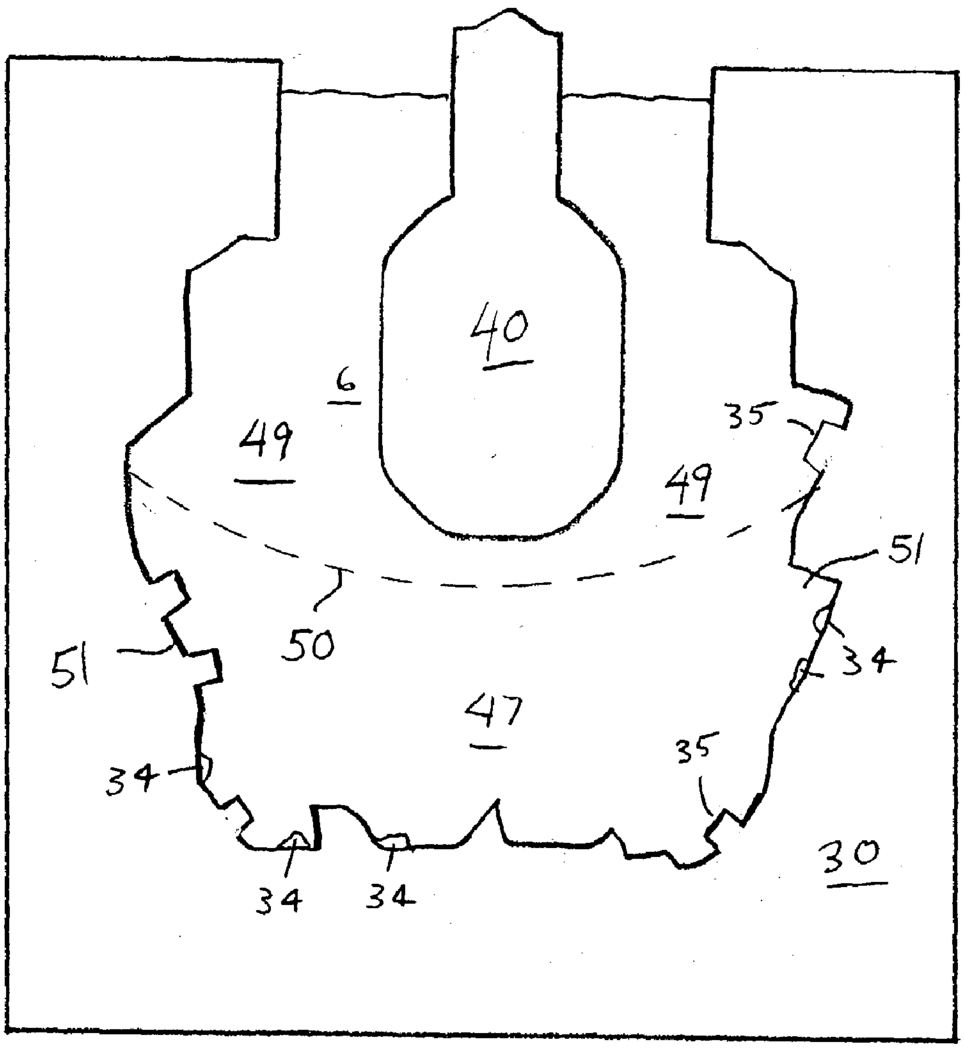
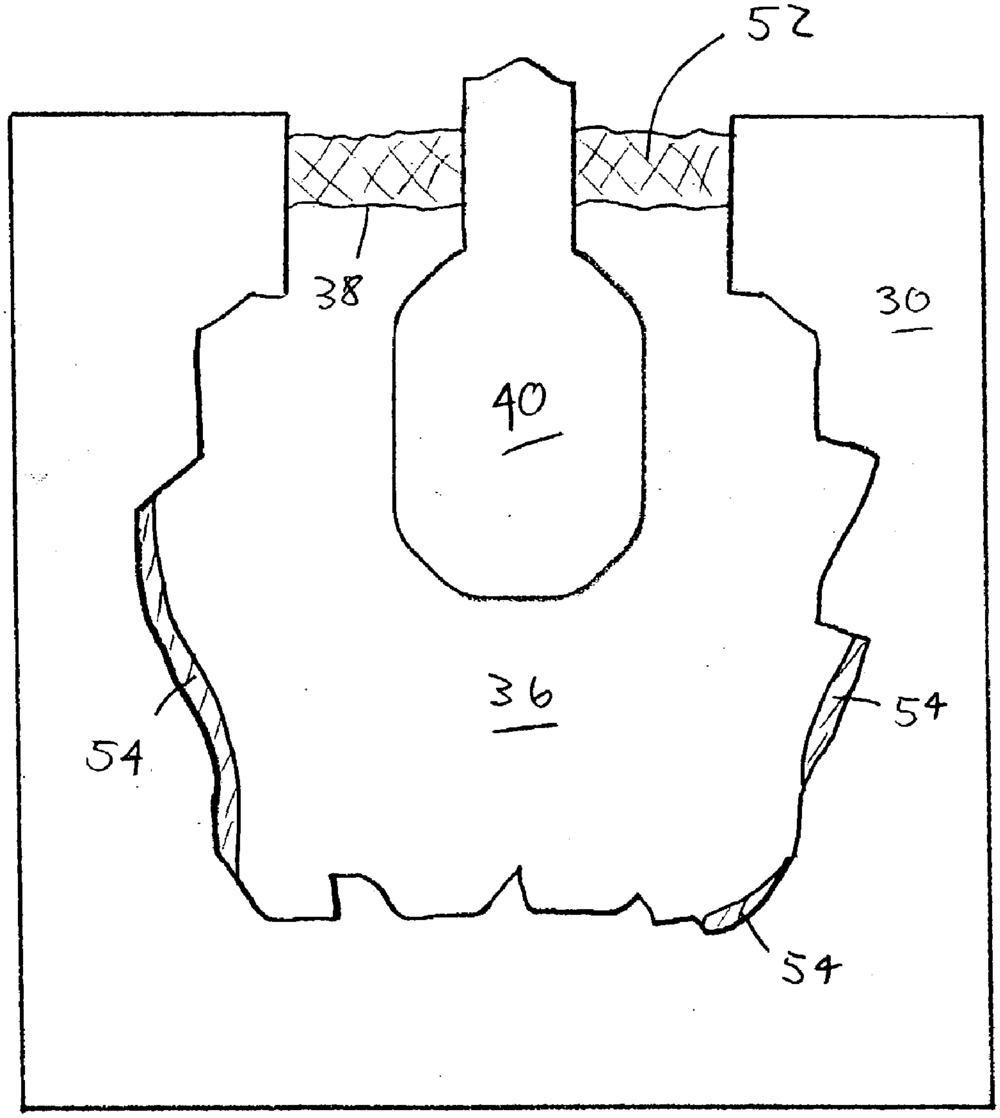


FIG 4



DRILL BIT BODY WITH MULTIPLE BINDERS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is related to co-pending U.S. patent application Ser. No. ______, entitled "Improved Bonding of Cutters in Diamond Drill Bits", filed ______, and Ser. No. ______, entitled "Bit Body Formed of Multiple Matrix Materials and Method for Making the Same", filed ______, the contents of each of which are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates, most generally, to a composition for a matrix body of a drill bit and other cutting or drilling tools, and a method for forming the same.

BACKGROUND OF THE INVENTION

[0003] Various types of earth boring bits are used in various applications in today's earth drilling industry. The earth boring bits may be formed to include various shapes. Depending on the application, the drill bits may contain natural or synthetic diamonds, polycrystalline diamond (PCD) or grit hot-pressed (GHI) inserts, diamond-impregnated regions or combinations thereof, for drilling through earthen formations. The inserts, also known as cutting elements, are bonded to the bit body, often by brazing. The bit body is typically formed of a matrix material such as tungsten carbide, which is bonded into solid form by fusing a metallic binder material and the matrix material. This is commonly referred to as "infiltrating" the matrix material. To form the bit body, the tungsten carbide or other matrix material is disposed within a mold which is commonly formed of graphite and may be machined into any of various suitable shapes. The mold may be shaped to form a drill bit body that includes blades, teeth or other structural features.

[0004] Various forms of powdered tungsten carbide, for example, may be used as the matrix material and placed in the mold. The metal binder material, which may be composed of a single metal or metallic alloy, is typically placed over the tungsten carbide, then heated in a furnace to the flow or infiltration temperature of the binder material, at which the melted binder material infiltrates the tungsten carbide or other matrix material. By infiltration, it is meant that the molten binder material flows through the spaces between the matrix material grains by means of capillary action. More particularly, the infiltration process bonds the grains of the matrix material to each other and also bonds the matrix material to other structures that it contacts.

[0005] Natural or synthetic diamonds may be inserted into the mold prior to heating the matrix/binder mixture. Such diamonds become cemented to the bit body during infiltration and subsequent cooling. In such case, the drill bit is formed to include natural or synthetic diamonds. Alternatively, a bit may be formed by placing a mixture of tungsten carbide and diamond powder in desired locations within the mold prior to heating. In such case, a drill bit is formed having regions impregnated with diamond crystals. Inserts may then be joined to the bit body after the bit body is formed. PCD inserts may be joined to pockets or other receiving shapes that extend into the bit body, by brazing or other suitable means. Similarly, the grit hot-pressed inserts (GHIs) may be joined to holes that extend into the bit body, by brazing or other suitable means.

[0006] A steel or other metallic blank may be suspended within the mold. The blanks may be of various shapes. During the heating process, during which infiltration occurs, the molten binder materials also cause the matrix material to bond to the steel or other metallic blank. After formation of the bit body, a protruding section of the steel or other metallic blank may be welded to a second component called an upper section. The upper section typically has a tapered portion that is threaded onto a drilling string.

[0007] The chemical composition of the matrix material and the binder material are selected to provide a finished bit body having desired mechanical properties. Once a particular matrix material is chosen, the binder material then determines the mechanical properties of the finished bit body. These mechanical properties include transverse rupture strength (TRS), toughness (resistance to impact-type fracture), wear resistance (including resistance to erosion from rapidly flowing drilling fluid and abrasion from rock formations), steel bond strength between the matrix and steel reinforcing elements such as a steel blank, and strength of the bond (braze strength) between the finished body material and the PDC or GHI inserts.

[0008] The metallic binder material may be a single metal or a metallic alloy. According to conventional drill bit manufacturing, a single binder material is added to the matrix material to provide a property or one set of properties throughout the bit body. It would, however, be desirable to optimize the overall structure of the drill bit by providing different mechanical properties to the different portions of the drill bit body, in essence tailoring the bit body. For example, superior wear resistance is especially desirable at regions around the cutting elements, high strength and toughness are especially desirable at the bit blades and throughout the bulk of the bit body, and superior braze strength is desirable in the pockets or holes to which cutting inserts are brazed. These properties may be mutually exclusive if they are provided by different binder materials, for a given matrix material system. The choice of the single binder material therefore represents a compromise as the single binder material must be chosen to produce one or more of the properties, generally at the expense of another desirable property or properties.

[0009] It is therefore a shortcoming of the conventional art, that a drill bit cannot be formed to include different desirable mechanical properties in different regions of the drill bit. The present invention addresses these shortcomings.

SUMMARY OF THE INVENTION

[0010] The present invention is directed to a structural body such as a drill bit that includes different binder materials and therefore different properties, in different spatial locations of the structural body. The present invention also provides methods for forming such a structural body.

[0011] In an exemplary embodiment, the present invention provides a drill bit comprising a matrix material and having a first region including a first binder material therein, and a second region including a second binder material therein. The first binder material and second binder material provide different functional properties to the structural body in combination with the matrix material.

[0012] In one exemplary embodiment, a method for forming such a drill bit body is provided. The method comprises providing a mold and disposing matrix material within the mold. First and second binder materials are then introduced to the mold and the arrangement is then heated to form a bit body. The first and second binder materials are chosen to have different melting points, and the heating causes the first and second binder materials to migrate to different spatial locations within the matrix material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention is best understood from the following detailed description when read in conjunction with the accompanying drawings. It is emphasized that, according to common practice, the various features of the drawing are not to scale. On the contrary, the dimensions of the various features may be arbitrarily expanded or reduced for clarity. Like numerals denote like features throughout the specification and drawings. Included are the following figures:

[0014] **FIG. 1** is a perspective view of an exemplary drill bit of the present invention, in partial cross-section;

[0015] **FIG. 2** is a cross-sectional schematic view of a mold and materials for forming a drill bit according to one exemplary embodiment of the present invention;

[0016] **FIG. 3** is a cross-sectional schematic view showing the arrangement of **FIG. 2** after heating; and

[0017] **FIG. 4** is another cross-sectional schematic view of a mold and materials for forming a drill bit according to another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The present invention provides a structural body of matrix material, such as a drill bit body, in which different portions of the bit body are formed of different infiltration/binder materials in combination with a matrix material. In combination with the matrix material, the different infiltration/binder materials provide different desirable mechanical properties to the structural body. For brevity, the infiltration/binder materials are hereinafter referred to simply as binder materials. The mechanical properties are provided to the different spatial locations where they are most advantageous. The present invention also provides a method for forming the structural body using multiple binder materials. The method includes heating to cause the multiple binder materials to migrate to the different spatial locations of the structural body where the properties they provide are most needed. Although the present invention may be used to form various structural bodies of matrix material, the following discussion is directed to the exemplary embodiment in which the structural body is a drill bit body. The drill bit body embodiment is provided to be illustrative, and not restrictive of the present invention.

[0019] **FIG. 1** shows an exemplary drill bit in partial cross-section. More specifically, **FIG. 1** shows drill bit **2** having bit body **4** and including core **6**. Internal to bit body **4** is opening **8** to which is attached a steel or other metal blank. For clarity, the steel or other metal blank is not illustrated in **FIG. 1**, but it should be understood that a metal blank will occupy opening **8** upon formation of the bit body **4**. The bit body is formed bonded to the metal blank, as will be shown in subsequent figures. The configuration of drill bit **2** shown in **FIG. 1** is intended to be exemplary only.

[0020] Drill bit **2** includes exemplary blades **10** and a plurality of pockets **12** to receive cutting elements **14**. Cutting elements **14** each include cutting face **13** which may be formed of polycrystalline diamond (PCD) or polycrystalline cubic boron nitride (PCBN), or a mixture thereof, in exemplary embodiments.

[0021] Different "regions" of drill bit **2** are apparent from **FIG. 1**. The regions include the bulk of the bit body including core **6**, blades **10**, blade surface **20**, other surfaces **21** (namely the bit gage), pockets **12**, surface regions **16** adjacent pockets **12**, and the interface region **18** which interfaces with the metallic blank (opening **8** in the illustration of **FIG. 1**). Such "regions" are arbitrarily designated for illustrative purposes. These and other differently designated regions of a bit body may be formed to include different functional properties or sets of functional properties to the portion of the solid drill bit body that it forms. These functional properties include, but are not limited to a desirable degree of transverse rupture strength (TRS), a desirable degree of toughness (resistance to impact-type fracture), a desirable degree of wear resistance (including resistance to erosion from rapidly flowing drilling fluid and abrasion from rock formations), a desirable degree of hardness, a desirable degree of abrasion resistance, a desirable degree of steel bond strength between the matrix material and steel reinforcing elements such as a metallic blank, and a desirable degree of braze strength between the finished body material and a PCD insert, GHI insert, or other cutting element brazed to the bit body. By "functional property", it is meant that the mechanical property of interest, is exhibited to a degree such that the portion of the solid drill bit body is considered to demonstrate a degree of the mechanical property that is advantageous and desirable for its application.

[0022] Referring to drill bit **2** of **FIG. 1**, it is desirable to form outer surfaces **20** and **21** to posses good erosion resistance, hardness and strength because they are exposed to various drilling fluids. Moreover, it is desirable to form core **6** to posses superior toughness as it forms the bulk of the bit body. Pockets **12**, which receive cutting elements **14**, should be formed to provide for superior braze strength since cutting elements **14** will be brazed to such pockets. Interface region **18** should be formed to provide superior metal bond strength because a steel or other metallic blank will be bonded to this region. It is also desirable to form surface regions **16** that are near pockets **12** on blades **10**, to have superior wear resistance since they are exposed to the earth formations during drilling and may therefore endure severe abrasion. The regions of the drill bit and the desirable properties associated therewith, are intended to be exemplary only. Different "regions" may be designated to advantageously include different properties, in other exemplary embodiments.

[0023] In an exemplary embodiment, the multiple binder materials are used to advantageously provide different desired mechanical or functional properties (as described above) to different exemplary regions of a structural body such as drill bit **2**. It should be emphasized that drill bit **2**

illustrated in **FIG. 1** is intended to be exemplary only and various other drill bits having various other shapes including different blade configurations and cutting element locations, and therefore other "regions", may be used in other exemplary embodiments. The drill bits may be PDC or other drag bits, or other earth boring devices.

[**0024**] The mechanical/functional properties provided to the drill bit body are a function of the combination of the matrix material and the binder material. For a given matrix material, the binder material determines the different properties. The effect of the various binder materials may differ when different matrix materials are used. The present invention is applicable to matrix materials systems formed of various matrix materials or combinations of matrix materials. For descriptive purposes, the following discussion is directed to an exemplary system in which the matrix material is tungsten carbide. The tungsten carbide matrix material may represent a single type of tungsten carbide or a mixture of various types of tungsten carbide.

[**0025**] **FIG. 2** is a schematic cross-sectional view showing matrix material **36** disposed within mold **30**. Mold **30** defines the shape of the bit body and will generally be shaped to produce blades, teeth and other cutting surfaces in the formed bit body. Mold **30** is typically formed of graphite and may also include displacements **35** which produce pockets or other indentations that extend into the formed bit body, for accommodating PCD inserts or other cutting elements which are joined to the pockets by brazing. In an exemplary embodiment, diamond pieces **34** may be added along surface **32** of mold **30** prior to the addition of matrix material **36**. Diamond pieces **34** may be natural or synthetic diamonds. If such diamonds are added, the bit body will be formed to include these diamond pieces on its surface upon solidification. Steel blank **40** is suspended within mold **30**. Steel blank **40** is exemplary only and other metal blanks may be used in other exemplary embodiments.

[**0026**] Matrix material **36** is tungsten carbide and may represent a single form of tungsten carbide or a mixture of various types of tungsten carbide powders, in various exemplary embodiments. Drill bits formed of tungsten carbide, WC, or other similarly hard metal matrix materials, have the advantage of higher wear and erosion resistance. After optional diamonds **34** are positioned within mold **30**, the mold is packed with matrix material powder.

[**0027**] The various types of tungsten carbide may include macro-crystalline tungsten carbide, cast tungsten carbide, carburized tungsten carbide and sintered tungsten carbide. Macro-crystalline tungsten carbide is essentially a stoichiometric tungsten carbide (i.e., WC) that is, for the most part, in the form of single crystals. Some large crystals of macro-crystalline tungsten carbide are bi-crystals. Cast tungsten carbide is a eutectic two-phase carbide composed of WC and W_2C. Carburized tungsten carbide is a type of tungsten carbide that is different from macro-crystalline tungsten carbide, cast tungsten carbide, and cemented or sintered tungsten carbide. Carburized tungsten carbide is a product of the solid-state diffusion of carbon into tungsten metal at high temperatures in a protective atmosphere. Carburized tungsten carbide grains are generally multi-crystalline, i.e., they are composed of tungsten carbide agglomerates. The agglomerates form grains that are larger than the individual tungsten carbide crystals. Sintered tungsten carbide signifies tungsten carbide particles that have been pre-sintered to include cementing or binder agents such as cobalt. In one embodiment, matrix material **36** may be one of the above-listed types of tungsten carbide matrix material, while in other exemplary embodiments, multiple grades or more than one of the aforementioned types of tungsten carbide may be provided as a mixture to form a relatively homogenous matrix material **36** within mold **30**. In another exemplary embodiment, the different grades or types of tungsten carbide matrix material may be disposed at different locations within mold **30**. In yet another exemplary embodiment, different mixtures of matrix materials may be disposed in different locations within mold **30**.

[**0028**] After the tungsten carbide matrix material **36** is disposed within mold **30**, first binder material **46** is provided over upper surface **38** of matrix material **36** according to the exemplary embodiment illustrated in **FIG. 2**. Second binder material **48** is also added over upper surface **38** and in the illustrated exemplary embodiment, second binder material **48** is a layer disposed over a layer of first binder material **46**. Each of the binder materials may be provided in the form of small slugs placed over matrix material **36** and around steel blank **40**. In other embodiments, the binder materials may be provided in other forms such as a powder. In the illustrated embodiment, the binder materials are introduced into mold **30**.

[**0029**] The two binder materials **46** and **48** are chosen to have different melting points and to provide different mechanical/functional properties to the drill bit as formed. In one exemplary embodiment, the two binder materials may include melting points that differ by at least 100° F., but other melting point variations may be used in other embodiments. In one exemplary embodiment, the binder material with the higher melting point may be formed as second binder material **48**, in a layer over first binder material **46**. According to another exemplary embodiment, the higher melting point binder material may be first binder material **46** adjacent matrix material **36**. According to still another exemplary embodiment (as will be shown in **FIG. 4**) the two matrix materials may be intermixed to form a single layer.

[**0030**] The binder material may be a metal such as cobalt, iron, copper, nickel, manganese, zinc, tin and/or mixtures or alloys thereof. Binder material alloys are commonly formed to include at least copper and nickel. Exemplary binder alloys are disclosed in U.S. Pat. No. 6,461,401, issued on Oct. 8, 2002, the contents of which are herein incorporated by reference. One exemplary binder alloy includes a melting point of about 1635° F. and includes nickel in the range of about 0-15% by weight, manganese in the range of about 0-25% by weight, zinc in the range of about 3-20% by weight, tin in the range of more than 1% to about 10% by weight, and copper in the range of about 24-96% by weight. Another exemplary binder alloy includes manganese in a range of about 0-24% by weight, nickel in a range of about 0-15% by weight, zinc in a range of about 3-20% by weight, and copper in a range of about 30-98% by weight and includes a melting point of about 1800° F. Many other different binder material alloys are known in the art. Mixtures most commonly used for commercial purposes, including diamond drill bit making, are described in a publication entitled Matrix Powders for Diamond Tools, Kennametal Inc., Latrobe, Pa. (1989).

[0031] One commonly used binder alloy has a composition by weight of about 52% copper, 15% nickel, 23% manganese, and 9% zinc. This exemplary alloy has a melting temperature of about 1800° F. (968° C.) and an infiltration temperature of about 2050° F. (1162° C.). Other known alloys use combinations of copper, nickel and zinc, or copper, nickel and up to about 1% tin by weight. The aforementioned binder materials are intended to be exemplary, as various other binder materials and binder alloys formed of different materials and having different melting points, may be used in other exemplary embodiments.

[0032] Each binder material is known to provide a distinct property or properties to the particular matrix material which it infiltrates. The binder materials are selected to have different melting points so that the lower melting point binder material melts and infiltrates the matrix material first, and the higher melting point binder material melts and infiltrates the matrix material second. In the illustrated embodiment, the different melting points, in combination with the effects of gravity, enable the lower melting point binder material to migrate to a lower position within the mold than the binder material with the higher melting point.

[0033] According to one exemplary method of the present invention, the high and low melting point binder materials are added over top surface **38** of matrix material **36**, either as a mixture or a plurality of layers, and the mold and its contents are heated. Such heating may alternatively be referred to as sintering. The low and high melting point binder materials have correspondingly relative flow/infiltration temperatures. The exemplary method also includes heating past the melting and flow/infiltration temperatures of the binder materials. The lower melting point binder material melts and begins to infiltrate matrix material **36** first (after the flow/infiltration temperature has been reached). The heating continues as the high melting point binder material eventually melts and also infiltrates matrix material **36** when its flow/infiltration temperature has been reached. Since the lower melting point binder material melts and infiltrates first, gravity causes the lower melting point binder material to begin descending through the matrix material sooner. After the heating process, the mold and materials therein are cooled.

[0034] **FIG. 3** shows the arrangement shown in **FIG. 2** after heating has caused the binder materials to infiltrate the matrix material. The heating time, gradient, and temperatures, as well as the cooling gradient, are chosen such that the low melting point binder material (which may be first binder material **46** or second binder material **48**) reaches lower region **47** of matrix material **36** within mold **30**, while the high melting point binder material does not reach lower region **47**, but, rather, remains in upper region **49**. In this manner, the lower melting point binder material and higher melting point binder material infiltrate different spatial locations, for example, lower region **47** and upper region **49**, respectively. The heating time, gradient and temperature may alternatively be chosen such that some of the low melting point binder material reaches lower region **47** while some of the low melting point binder material remains in upper region **49** along with the high melting point binder material.

[0035] According to one exemplary embodiment, a continuous heating process is carried out after both of first binder material **46** and second binder material **48** have been provided over matrix material **36**. In another exemplary embodiment, after first binder material **46** is added, the arrangement is heated and second binder material **48** added during the heating process. In yet another exemplary embodiment, second binder material **48** is not added until after first binder material **46** has been heated to infiltrate the matrix material and the arrangement has been cooled.

[0036] According to the various heating/cooling embodiments, a drill bit body is formed from matrix material **36** that is infiltrated with binder materials that bond or cement the matrix material into solid form. The binder material also bonds the matrix material to steel blank **40**. Once the matrix material **36** is solidified and separated from mold **30** in **FIG. 3**, it constitutes the bit body.

[0037] Upper region **49** of the bit body includes core region **6** and lower region **47** of the bit body includes surface regions such as the surfaces of blades **51**. In one exemplary embodiment, the lower melting point binder material which migrates to lower region **47**, may be chosen to provide superior braze strength to the region where the cutters will be joined and wear resistance to regions near such cutters, whereas the higher melting point binder material may be chosen to provide strength and toughness to the bit blades and bit body including the core. In the illustrated embodiment, the binder materials cement the matrix material and also cause optional diamond pieces **34** to become bonded to the drill bit body at the surface of the formed drill bit body, when the arrangement is heated and cooled.

[0038] The mold **30** illustrated in **FIG. 3**, as well as lower and upper regions **47** and **49**, respectively, are intended to be exemplary only. Furthermore the position and shape of dashed line **50**, which divides lower region **47** from upper region **49**, is exemplary only. In other exemplary embodiments, the drill bit configuration may allow the binder materials and the heating conditions to be chosen such that lower region **47** includes the entirety of the blades and pockets of the exemplary drill bit. This is also determined by the configuration of the drill bit to be formed, including the configuration and location of the blades and locations of the pockets.

[0039] **FIG. 4** depicts another exemplary arrangement for forming a drill bit according to another exemplary embodiment of the present invention. Prior to the addition of matrix material **36** into mold **30**, powder mixture **54** is disposed at multiple locations within mold **30** and includes a mixture of tungsten carbide and diamond crystals. In one exemplary embodiment, powder mixture **54** may be in paste form. In this embodiment, when the drill bit body is formed by the heating and cooling process, the bit body is formed to include polycrystalline diamond in regions that include powder mixture **54**.

[0040] **FIG. 4** also illustrates another exemplary embodiment of the present invention. Binder material **52** is formed over top surface **38** of matrix material **36** and is a mixture of two binder materials—a relatively high melting point binder material and a relatively low melting point binder material. Each of the relatively low melting point binder material and the relatively high melting point binder material may be one of the various materials, including alloys, discussed above. After mold **30** is provided and matrix material **36** is disposed within mold **30**, the lower melting point binder material and the higher melting point binder material are provided as a mixture in binder layer **52**, and the arrangement is then heated. The lower melting point binder material melts first and infiltrates first when its infiltration/flow temperature is reached, and the higher melting point binder material melts and infiltrates later, when its higher infiltration/flow temperature is reached. In an exemplary embodiment, the lower melting point binder material migrates to a lower position within the mold and therefore a spatially different location in the formed drill bit body, than the higher melting point binder material, which remains superjacent the lower melting point binder material. For example, the higher melting point binder material may infiltrate an upper region such as upper region **49** shown in **FIG. 3**, while the lower melting point binder material may infiltrate lower region **47** as shown in **FIG. 3**.

[**0041**] According to another exemplary embodiment, more than two distinct binder materials can be used. The multiple binder materials are chosen to have distinct melting points and therefore, correspondingly different infiltration temperatures. The multiple binder materials may be mixed, added in layers or blended with matrix materials as previously described. In an exemplary embodiment, the multiple binder materials will each include a melting point that differs from the others by at least 100° F. The infiltration of the matrix material takes place in stages with the lower melting point binder material reaching a lower portion within the mold and the highest melting point binder material remaining in an upper portion of the mold, while an intermediate melting point binder material is interposed between the lower and upper portions of the mold.

[**0042**] According to the various exemplary embodiments, after the heating process is ceased, the arrangement is cooled using an appropriate cooling gradient. The cooled and solidified matrix material **36** forms a drill bit body and is removed from mold **30**. The tungsten carbide drill bit body is bonded to steel blank **40** as formed. As formed, the drill bit body includes different properties, discussed above, in different spatial locations. The drill bit body may then have cutting elements joined to pockets, holes or other cavities that extend into the bit body, by brazing.

[**0043**] The preceding merely illustrates the principles of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the invention and are included within the scope and spirit. Furthermore, all examples and conditional language recited herein are principally intended expressly to be only for pedagogical purposes and to aid in understanding the principles of the invention and the concepts contributed by the inventors to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and the functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents and equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure. The scope of the present invention, therefore, is not intended to be limited to the exemplary embodiments shown and described herein. Rather, the scope and spirit of the present invention is embodied by the appended claims.

What is claimed is:

1. A method for forming a bit body comprising:

providing a mold;

disposing matrix material within said mold;

introducing a first binder material and a second binder material to said mold; and

heating to form a bit body.

2. The method as in claim 1, wherein said heating causes said first binder material to infiltrate a first portion of said matrix material and said second binder material to infiltrate a second portion of said matrix material.

3. The method as in claim 2, wherein said first portion and said second portion are different.

4. The method as in claim 2, wherein said second binder material has a higher melting point than said first binder material and said second portion is superjacent said first portion.

5. The method as in claim 1, wherein said heating causes said first binder material to infiltrate a first portion and a second portion of said matrix material and said heating causes said second binder material to infiltrate substantially only the second portion of said matrix material.

6. The method as in claim 1, wherein said heating causes said first binder material to infiltrate a first portion of said matrix material and provide at least a first functional property and said second binder material to infiltrate a second portion of said matrix material and provide at least a second functional property being different from the first property, each of said first functional property and said second functional selected from the group consisting of a desirable degree of braze strength, a desirable degree of erosion resistance, a desirable degree of abrasion resistance, a desirable degree of steel bond strength, a desirable degree of toughness, a desirable degree of hardness, and a desirable degree of transverse rupture strength.

7. The method as in claim 1, further comprising introducing a third binder material to said mold prior to said heating.

8. The method as in claim 1, further comprising disposing diamond pieces within said mold prior to said disposing matrix material.

9. The method as in claim 1, wherein said disposing and said introducing comprise intermixing said first binder material and said second binder material within said matrix material.

10. The method as in claim 1, further comprising providing a mixture of polycrystalline diamond and one of said matrix material and a further matrix material, in locations within said mold.

11. The method as in claim 1, in which said introducing a first binder material and a second binder material comprises providing a mixture of said first binder material and said second binder material over said matrix material.

12. The method as in claim 1, in which said first binder material has a first melting point and said second binder material has a second melting point, said second melting point being greater than said first melting point by at least 100° F.

13. The method as in claim 12, further comprising introducing a third binder material to said mold, said third binder material having a third melting point being greater than said second melting point by at least 100° F.

14. The method as in claim 1, wherein said heating comprises initially heating to a first temperature sufficient to cause said first binder material to infiltrate said matrix material, then heating to a second temperature sufficient to cause said second binder material to infiltrate said matrix material.

15. The method as in claim 1, wherein said first binder material has a melting point of about 1650° F. and said second binder material has a melting point of about 1800° F.

16. The method as in claim 1, wherein said first binder material comprises a first alloy comprising manganese in a range of about 0 to 25% by weight, nickel in a range of about 0 to 15% by weight, zinc in a range of about 3 to 20% by weight, tin in a range of about 6 to 7% by weight, and copper in a range of about 24 to 96% by weight of said first alloy composition, and

said second binder material comprises a second alloy comprising manganese in a range of about 0 to 24% by weight, nickel in a range of about 0 to 15% by weight, zinc in a range of about 3 to 20% by weight, and copper in a range of about 30 to 98% by weight of said second alloy composition.

17. The method as in claim 1, in which said first binder material and said second binder material provide different properties to said bit body in combination with said matrix material.

18. The method as in claim 1, wherein said disposing a matrix material comprises disposing multiple grades of a tungsten carbide matrix material within said mold.

19. The method as in claim 1, wherein said mold includes displacements that form cavities that extend into said bit body.

20. The method as in claim 19, wherein said heating causes said first binder material to infiltrate a first portion of said matrix material that includes said displacements and further causes said second binder material to infiltrate a second portion of said matrix material, said first portion being different from said second portion.

21. The method as in claim 1, wherein said introducing a first binder material and a second binder material to said mold comprises providing said first binder material over said matrix material and providing said second binder material over said matrix material.

22. The method as in claim 21, further comprising further heating after said providing a first binder material and prior to said providing a second binder material.

23. The method as in claim 21, wherein said providing a first binder material comprises forming a first layer of said first binder material over said matrix material and said providing a second binder material comprises forming a second layer of said second binder material over said first layer.

24. The method as in claim 23, in which said first binder material has a first melting point and said second binder material has a second melting point that is higher than said first melting point.

25. A method for tailoring portions of a bit body comprising:

providing matrix material within a mold;

infiltrating a first portion of said matrix material with a first binder material; and

infiltrating a second portion of said matrix material with a second binder material.

26. The method as in claim 25, wherein said infiltrating a first portion of said matrix material provides a first property selected from the group consisting of abrasion resistance, toughness, hardness, erosion resistance, braze strength, and bond strength to said bit body, and said infiltrating a second portion of said matrix material provides a second property selected from the group consisting of abrasion resistance, toughness, hardness, erosion resistance, braze strength, and bond strength, to said bit body, said first property being different than said second property.

27. The method as in claim 25, wherein said infiltrating a first portion and said infiltrating a second portion comprise heating said mold, said matrix material and said first and second binder materials.

28. The method as in claim 27, wherein said heating operation includes initially heating to a first temperature sufficient to cause said infiltrating a first portion of said matrix material, then heating to a second temperature sufficient to cause said infiltrating a second portion of said matrix material.

29. A drill bit having a bit body comprising a matrix material and having a first region including a first binder material therein and a second region including a second binder material therein.

30. The drill bit as in claim 29, wherein said first region includes a surface of said bit body and said second region includes a core of said bit body.

31. The drill bit as in claim 30, wherein said first region includes pockets extending into said bit body and adapted for receiving corresponding cutting elements.

32. The drill bit as in claim 29, wherein said first region provides different brazing properties than said second region.

33. The drill bit as in claim 29, wherein at least part of said bit body is formed of said matrix material in combination with polycrystalline diamond.

34. The drill bit as in claim 29, wherein said first region has a first functional property and said second region has a second functional property, said second functional property being different from said first property,

each of said first functional property and said second functional selected from the group consisting of a desirable degree of braze strength, a desirable degree of erosion resistance, a desirable degree of abrasion resistance, a desirable degree of steel bond strength, a desirable degree of toughness, a desirable degree of hardness, and a desirable degree of transverse rupture strength.

35. The drill bit in claim 29, in which said matrix material comprises multiple types or grades of tungsten carbide.

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