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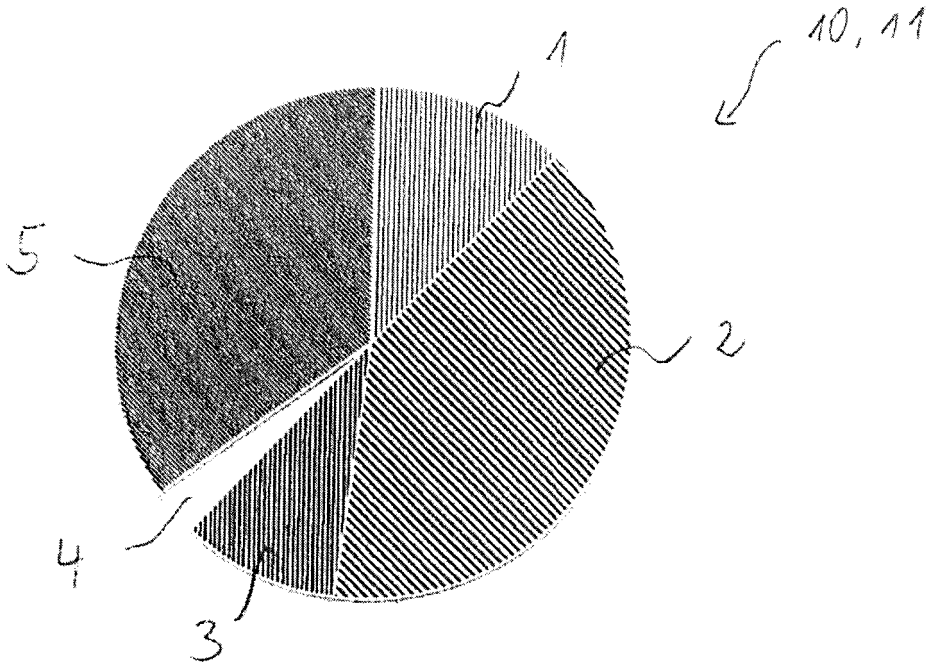
(54) **A GREEN BODY, A GRINDING WHEEL AND A METHOD FOR MANUFACTURING AT LEAST A GREEN BODY**

(57) A green body comprises a primary grit in an amount of 5% to 40% by volume, based on 100% by volume of the green body, a vitrified bond in an amount of 20% to 60% by volume, based on 100% by volume of the green body, a gum arabic in an amount of 5% to 20% by volume, based on 100% by volume of the green body, a pore forming material in an amount of 0% to 20% by volume, based on 100% by volume of the green body; and a secondary grit in an amount of 0% to an amount sufficient to bring the green body to 100% by volume.

Fig. 1



EP 3 666 462 A1

Description

[0001] The present invention relates to a green body, a grinding wheel and a method for manufacturing at least a green body, particularly a green body with high environmental compatibility and handling stability.

[0002] Although the invention is explained and discussed in conjunction with a green body for grinding segments as well as a corresponding grinding wheel, the principles of the invention may easily be transferred to other types of polishing tools, cutting tools or other tools for grinding processes.

[0003] Gum arabic, also known as aracia gum, chaar gund, char goond, or meska, is a natural gum made of the hardened sap of various species of the acacia tree. Gum arabic can be collected from the species Senegalia (Acacia) and Vachellia (Acacia) seyal of the acacia tree.

[0004] In the production of grinding segments for grinding wheels, usually temporary binders are used. The temporary binder is necessary as pressing aid for pressing the grinding segments and to improve the mechanical stability of the grinding segments after pressing. The common temporary binders, for example phenolic resins or other polymers, need typically special furnaces with exhaustion systems are necessary.

[0005] Therefore, there is need for a temporary binder in the grinding wheel industry which doesn't require the mentioned special furnaces.

[0006] That is to say that a temporary binder is needed for which the machinery and equipment effort can be reduced. Additionally, there is need for a temporary binder with high environmental compatibility.

[0007] Gum arabic as temporary binder which burns out of the finished product during the sintering process, is especially advantageous due to its typical characteristic namely high environmental compatibility. One of the ideas on which the present invention is based is to use gum arabic as additive for grinding wheel production to improve the pressing process and handling stability of the green part prior to the sintering process.

[0008] According to EU environmental policy it is not obligatory to mark it as hazardous contaminant. By using gum arabic as temporary binder the machinery and equipment effort can be clearly reduced. Since gum arabic is an organic temporary binder it burns out during sintering process without any combustion residues or dangerous emissions. Further, an application of gum arabic is easier and more homogeneous than with other established polysaccharides like sugar solutions or food starch. Due to its eco-friendly and manufacturing conditions optimizing properties the utilization of gum arabic in vitrified grinding tools is a forward looking technology.

[0009] EP 2 175 002 A1 relates to an abrasive composition.

[0010] This need is met by a green body having the features of claim 1, a method for manufacturing at least a green body having the features of claim 6 and a grinding wheel having the features of claim 12.

[0011] Before sintering, a green body is usually very sensitive and has no good stability, which makes handling of the green body slow and difficult. This leads to low manufactured parts output rates. Additionally inaccuracies occur with respect to geometrical shape. Edge breakouts and material loss are further disadvantages. Theses aspects can be counteracted with the here described gum arabic as temporary binder. Productivity, accuracy as well as product manipulation are improved on an environmentally friendly resources saving manner.

[0012] The features of the green body are also disclosed for the method for manufacturing at least a green body and vice versa.

[0013] A first aspect of the disclosure pertains to a green body comprising a primary grit in an amount of 5% to 40% by volume, preferably in an amount of 10% to 35% by volume, and more preferably in an amount of 15% to 25% by volume, based on 100% by volume of the green body; a vitrified bond in an amount of 20% to 60% by volume; preferably in an amount of 25% to 40% by volume, based on 100% by volume of the green body; a gum arabic in an amount of 5% to 20% by volume; preferably in an amount of 7% to 17% by volume; and more preferably in an amount of 8% to 12% by volume, based on 100% by volume of the green body; a pore forming material in an amount of 0% to 20% by volume; preferably in an amount of 0% to 15% by volume, based on 100% by volume of the green body and a secondary grit in an amount of 0% to an amount sufficient to bring the green body to 100% by volume. In other words the green body is based on a powder composition, wherein the powder composition can be molded or formed to a green body.

[0014] The gum arabic can be applied as powder with a particle size of about 10 μm to 250 μm. The gum arabic can be delivered from Caesar & Loretz GmbH (Germany) (Gummi Arabicum, Produkt Nummer 448).

[0015] According to a second aspect of the disclosure, a method for manufacturing at least a green body, particularly a green body to the first aspect of the disclosure is disclosed. The method comprises a step A of providing a powder composition comprising a primary grit in an amount of 5% to 40% by volume, preferably in an amount of 10% to 35% by volume; and more preferably in an amount of 15% to 25% by volume, based on 100% by volume of the powder composition, a vitrified bond in an amount of 20% to 60% by volume, preferably in an amount of 25% to 40% by volume, based on 100% by volume of the powder composition, a gum arabic in an amount of 5% to 20% by volume, preferably in an amount of 7% to 17% by volume; and more preferably in an amount of 8% to 12% by volume, based on 100% by volume of the powder composition, a pore forming material in an amount of 0% to 20% by volume, preferably in an amount of 0% to 15% by volume, based on 100% by volume of the powder composition and a secondary grit in an

amount of 0% to an amount sufficient to bring the powder composition to 100% by volume. Further the method comprises a step B by portioning and forming the powder composition into the at least one green body.

[0016] For providing the powder composition of step A, an exact weighing of each component of the powder composition is performed. Depending on the geometry and the material of a workpiece to be grinded, the shape, the dimensions and the ingredients of the grinding segment have to be defined.

[0017] The amount of components is defined by the volume of the grinding segments, which results from the dimensions of the grinding segment. The composition of the powder composition is defined by percentage of volume and the corresponding densities. All components in form of a dry powder of the powder composition can be mixed. By mixing the components a homogeneous distribution of the components can be obtained. The mixed powder composition can be portioned and formed into at least one green body in the corresponding further method step (step B).

[0018] According to a third aspect of the disclosure, a grinding wheel comprises grinding segments, wherein the grinding segments are obtained by sintering the green body and are positioned and glued onto a blank.

[0019] One of the ideas on which the present invention is based is to use gum arabic as an organic temporary binder for the production of grinding wheels with vitrified bond type. Due to its eco-friendly and manufacturing conditions optimizing properties the utilization of gum arabic in vitrified grinding tools is a forward looking technology. Gum Arabic can be used to improve handling stability of a green body prior to the sintering process. A bonding type of corresponding grinding wheels can be a vitrified bonding type.

[0020] According to some embodiments of the green body, the primary grit comprises super abrasive grits with a mean grit size from 2μm to 300μm; preferably 3pm to 200μm; and more preferably 45pm to 130μm. The grit sizes are defined by the FEPA standard (FEPA = Federation of the European Producers of Abrasives).

[0021] The grit size can depend on the operational area of the grinding wheel. Super abrasive grits can be made up of diamond or CBN (Cubic Boron Nitride). Super abrasive grits are applied from different suppliers like Element Six Ltd. (Ireland), Sandvik Hyperion (Germany), EID Ltd. (United Kingdom), Duratec Hartstoffe GmbH (Germany), L.M. van Moppes & Sons SA (Switzerland) or WorldWide Superabrasives LLC (USA) in differing types from blocky to splintery or from amber to black versions. Examples for diamond and CBN products are ABN, PDA (from Element Six Ltd.); CBN Type I, RVG, SP1S (from Sandvik Hyperion); EBN, ERD(from EID Ltd.); BBN-J (from Duratec Hartstoffe GmbH); FRD(from van Moppes & Sohn SA); and BMI(from WorldWide Superabrasives LLC).

[0022] According to some other embodiments of the green body, the vitrified bond comprises at least one glass frit. As the vitrified bond different glass frits in powder form from Reimbold & Strick (Germany) (A4015 P Bindefritte Gem.), Ferro GmbH (Germany) (DSCE K 2247 Transparent - 1376714, VK6327(90158), Heraeus Schauer GmbH (Austria) (IS FTR90741 F Frit farblos - Spezialglas TGF2584AF) or Prince Minerals LLC (USA) (Ceramic Bond for CBN Grit - 872063-25, Ceramic Bond - 865060-25, Ceramic Bond Modifier - 872064-1) can be used.

[0023] According to some other embodiments of the green body, the pore forming material comprises graphite or glass bubbles. Under the term "pore forming material" also "porosity generating substances" can be understood. The pore forming material can be delivered from 3M Company (USA), Omega Minerals Germany GmbH (Germany) or Tokai Carbon Europe GmbH (Germany).

[0024] According to some other embodiments of the green body, the secondary grit comprises aluminum oxide, silicon carbide, boron carbide or boron nitride. The grit size of the secondary grit can be chosen dependent on the grit size of the primary grit. For example the grit size of the secondary grit can be the same size as the primary grit or the grit size of the secondary grit can be one size smaller than the primary grit, with grit sizes according to FEPA Standard. The secondary grit can be delivered from 3M Company (USA), Imerys Fused Minerals Villach GmbH (Austria) or Saint Gobain Ceramics Materials (Germany).

[0025] According to some other embodiments, a grinding segment is provided by sintering the green body. During sintering of the green body the gum arabic burns out of the green body. By burning out the gum arabic, vitrified bonds can be developed within the green body and the at least one grinding segment can be manufactured.

[0026] According to some other further embodiments, the powder composition is provided by weighting and mixing the primary grit, the vitrified bond, the gum arabic, the pore forming material and the secondary grit in a shaker mixer.

[0027] Depending on the geometry and the material of a workpiece to be grinded and the requested wheel properties of the grinding application, the shape, the dimensions and the composition of the grinding segment has to be selected. The composition of the powder composition is defined by percentage of the volume of each component and the corresponding densities. All components in form of a dry powder of the powder composition can be mixed. By mixing the components a homogeneous distribution of the here described components can be obtained and the powder composition can be portioned in the corresponding further method step (process step B).

[0028] According to some other embodiments, the components in form of a dry powder of the powder composition can be mixed in a shaker mixer for example type T2F from Willy A. Bachofen AG - Maschinenfabrik (Switzerland) with a rotational speed from 23rpm to 101rpm and a mixing duration from 15min to 4 hours depending on a weight of the powder composition and the grit size of the primary grit from 2μm to 300μm. To avoid clumping in edges of a container used in the mixer the mixing can be interrupted from time to time and a container of the shaker mixer can be tapped.

Ceramic balls and chain parts can be added to the container to increase the homogeneity. For an advantageous homogeneity the components can be sieved through sieves with applied grit size depending mesh opening. All handling tools for the components like containers, scoops, hoppers, brushes are grit size depending multifold existing, so that basically no grit carryover with impurity of products can take place.

[0029] According to some other embodiments, the portioning of the powder composition into at least one green body is conducted with containers. The containers are emptied into a mold with at least one cavity. That is to say that the mixed and sieved raw material can be portioned in a further process step by a weighing automat type DWA 11 from Dr. Fritsch GmbH (Germany). In this kind of metering unit the powder composition can be filled in constant portions into containers. Then the portioned powder composition is formed into a green body. The forming can be done by pressing in a mold. The pressing process can be semi-automatic bi-directional with a specific pressure of 25 kN/cm^2 for example. Depending on the grit size and the composition of the powder composition a pressing velocity can be adapted, if necessary dwell times can be included. After the mold removing procedure the green body can be transported manually with the aid of a spatula onto a tray made up of Cordierite 128 (Steuler-KCH GmbH, Germany) covered with sand (pink aluminum oxide mesh 80), for example. The sands on the tray can prevent the green body from adhering on the tray during or after the sintering of the green body. So, the sintered green body or grinding segment can be easily removed from the tray after sintering. During the sintering the gum arabic burns out of the at least one green body such that the at least one grinding segment is produced. The at least one grinding segment can be used for manufacturing a grinding wheel.

[0030] According to some other embodiments, the sintering can be conducted with an averaged heating rate of about 20°C to 120°C per hour, preferably of 50°C to 70°C per hour. The at least one tray or a plurality of trays can be put on top of each other with cordierite spacers in between into a furnace. The furnace can be a model ST 68 HD BW from PYROTEC. The furnace is heated with an averaged heating rate of about 20°C to 120°C per hour, preferably of 50°C to 70°C degrees per hour and a maximum temperature between 600°C and 1100°C. This maximum temperature can then be held for up to an hour or longer before the furnace is cooled down again. The cool down procedure can take place with maximum cooling rate.

[0031] According to some other embodiments, the at least one grinding segment is deburred with a tumble vibratory grinder. After the sintering the at least one grinding segment can be deburred with a tumble vibratory grinder. The tumble vibratory grinder can be from Raytech Industries (USA). Afterwards, the at least one grinding segment can be machined to a defined height. This machining can be realized with a double disc grinder. This grinding machine can be from Hahn+Kolb Werkzeug GmbH (Germany).

[0032] According to some other embodiments, the at least one grinding segment is cleaned via an ultrasonic bath. Advantageously the at least one grinding segments can be cleaned via a ultrasonic bath for example for 15 min at 55°C and dried in a drying furnace, for example at 150°C for one hour. The ultrasonic bath can be an ultrasonic bath from HGH GmbH & Co. KG (Germany) and the drying unit can be a furnace from Nabertherm GmbH (Germany).

[0033] Afterwards the at least one grinding segment can be inspected for quality control for example. The quality of each batch can be documented via a lot of 50 grinding segments for example in respect of dimensions with digital measuring slide of Mitutoyo Corporation (Japan), density by a balance produced of Kern&Sohn GmbH (Germany) and young modulus measured frequency based nondestructively via a ZVUK 130 measuring device from Abrasive A.S. (Czech Republic) before the grinding segment is glued onto the blank.

[0034] According to some other embodiments, the at least one grinding segment is positioned and glued onto the blank such that the grinding wheel is produced.

[0035] According to some other embodiments, the at least one grinding segment is glued onto the blank with two component glue. Differing types of two component glue can be used depending on the application field, for example Scotch type 460 from 3M Company (USA). Therefore the grinding segment can be time efficiently assembled on the blank.

[0036] According to some other embodiments, the blank comprises a diameter between 120 mm and 1800 mm. The blank can be made of steel, aluminum or any other suitable material. The segments are positioned onto a blank. It is possible that the grinding wheel comprises grinding segments of various shapes for example of hexagonal, rectangular, round, triangular or pie-shapes.

[0037] The grinding segments can be arranged and fixed in a clockwise direction onto the blank, for example. The grinding wheel, which is assembled by a plurality of grinding segments, can be trimmed and be supplied with customized coolant bores, slots or grooves by water jet cutting. The water jet cutting machine can be supplied by Maximator Jet GmbH (Germany).

[0038] According to some other embodiments, the glued grinding segments of the grinding wheel are brought by lapping on a lapping machine towards an aimed topography, parallelism and flatness. The lapping machine can be supplied by Lapmaster Wolters GmbH (Germany). In a possible further quality control the topography, the parallelism and the flatness can be measured. To this end, standard tools like steel rulers, slip gauges, dial indicators and roughness measuring devices can be used. This device for roughness measuring can be supplied by Jenopitk (Germany).

[0039] The invention will be explained in greater detail with references to exemplary embodiments depicted in the drawings as appended.

[0040] The accompanying drawings are included to provide a further understanding of the present invention and are incorporated in and constitute a part of this specification. The drawings illustrate the embodiments of the present invention and together with the description serve to explain the principles of the invention. Other embodiments of the present invention and many of the intended advantages of the present invention will be readily appreciated as they become better understood by reference to the following detailed description. The elements of the drawings are not necessarily to scale relative to each other. Like reference numerals designate corresponding similar parts.

Fig. 1 schematically illustrates a pie chart of a powder composition for a green body and alternatively of a portioned green body according to an embodiment of the invention.

Fig. 2 schematically illustrates different geometrical shapes of a green body or a grinding segment after sintering of the green body according to an embodiment of the invention.

Fig. 3 schematically illustrates a grinding wheel according to an embodiment of the invention.

Fig. 4 schematically illustrates a grinding wheel according to another embodiment of the invention.

Fig. 5 schematically illustrates stages of a method for manufacturing at least a green body and at least a grinding segment according to an embodiment of the invention.

[0041] In the figures, like reference numerals denote like or functionally like components, unless indicated otherwise. Any directional terminology like "top", "bottom", "left", "right", "above", "below", "horizontal", "vertical", "back", "front", and similar terms are merely used for explanatory purposes and are not intended to delimit the embodiments to the specific arrangements as shown in the drawings.

[0042] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations may be substituted for the specific embodiments shown and described without departing from the scope of the present invention. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

[0043] Fig. 1 schematically illustrates a pie chart of a powder composition for a green body and alternatively of a portioned green body according to an embodiment of the invention.

[0044] The pie chart of the powder composition 11 for the green body 10 is schematically illustrated in Fig. 1. Fig. 1 shows a possible composition for the powder composition 11, wherein by portioning the powder composition 11 the green body 10 can be manufactured. In other words the composition of the powder composition 11 and the green body 10 is the same with the difference that for manufacturing the green body 10 the powder composition 11 can be portioned formed or pressed into a certain geometrical shape.

[0045] As illustrated in Fig. 1 the green body 10 and the powder composition 11 comprises a primary grit 1 in an amount of 12% by volume, a vitrified bond 2 in an amount by 40% by volume, a gum arabic 3 in an amount of 10% by volume, a pore forming material 4 in an amount of 3% and a secondary grit 5 in an amount of 35% by volume. The here described amounts of percentage by volume are based on 100% by volume of the green body 10 and the powder composition 11.

[0046] The primary grit 1 comprises super abrasive grits with a mean grit size of 2μm to 300μm. The grit size can depend on the operational area of the grinding wheel. Super abrasive grits can be made up of diamond or CBN (Cubic Boron Nitride). The vitrified bond 2 comprises at least one glass frit. The pore forming material 3 comprises graphite or glass bubbles. The secondary grit comprises aluminum oxide, silicon carbide, boron carbide or boron nitride.

[0047] Fig. 2 schematically illustrates different geometrical shapes of a green body or a grinding segment after sintering of the green body according to an embodiment of the invention.

[0048] As can be seen in the drawings of Fig. 2 the green body 10 can in general have different geometrical shapes, such as hexagonal, rectangular, round, triangular or pie-shaped. For special applications also an individual geometrical shape is conceivable. After sintering the green body 10 the corresponding grinding segment 20 with vitrified bonds is manufactured. By sintering the green body 10 the gum arabic 3 burns out of the green body 10 such that the grinding segment 20 is provided. In other words the gum arabic as a temporary binder supports a handling of the green body before sintering and vitrified bonds are created within the grinding segment 20 after the sintering. The geometrical shape of the grinding segments 20 depends on their application as parts of a grinding wheel 30 (see Fig. 3) as well as on a size of a blank 6 on which the grinding segments 20 are positioned and glued on to manufacture the grinding wheel 30.

[0049] The grinding segments 20 can comprise a thickness of greater than 6 mm, preferably between 3 mm to 6 mm. It is also possible to provide customized grinding segments 20 with a specific thickness.

[0050] Fig. 3 schematically illustrates a grinding wheel according to an embodiment of the invention.

[0051] As can be seen in the drawing of Fig. 3 the grinding segments 20 having hexagonal shape are positioned and

glued onto a blank 6. The grinding segments 20 can be glued onto the blank 6 with a two component glue. The blank 6 comprises steel, aluminium or other suitable material with a diameter between 120 mm and 1800 mm. The grinding segments 20 having a distance d to each other. The grinding wheel 30 which is assembled by a plurality of grinding segments 20, can be trimmed and be supplied with customized coolant bores, slots or grooves by water jet cutting. The distance d can be greater than 5 mm, preferably between 1 mm to 5 mm. It is also possible to provide customized grinding wheels 30 with tailored distance d. By the distance d between the pluralities of grinding segments 20 a coolant can be efficiently transported to the outside during operation.

[0052] Fig. 4 schematically illustrates a grinding wheel according to another embodiment of the invention.

[0053] The grinding wheel 30 as can be seen in the drawing of Fig. 4 is based on Fig. 3 with the difference that the plurality of grinding segments 20 comprises a triangular shape or pie-shape, respectively. The triangular shape or pie-shape can be applied for a grinding wheel 30 with a diameter of 120 mm to 1800 mm, for example. The blank 6 is fully covered by the plurality of grinding segments 20 (indicated by the round arrow), wherein the grinding segments 20 having the distance d to each other. The pie-shaped grinding segments 20 can be arranged and fixed in a clockwise direction onto the blank 6, for example. The grinding wheel 30, which is assembled by a plurality of grinding segments 20, can be trimmed and be supplied with customized coolant bores, slots or grooves by water jet cutting. In other words the grinding segments 20 do not have contact to each other. By the distance d between the pluralities of grinding segments 20 the coolant can be efficiently transported to the outside during operation.

[0054] Fig. 5 schematically illustrates stages of a method for manufacturing at least a green body and at least a grinding segment according to an embodiment of the invention.

[0055] In a first step A, the powder composition 11 comprising a primary grit 1 in an amount of 5% to 40% by volume; preferably in an amount of 10% to 35% by volume; and more preferably in an amount of 15% to 25% by volume, based on 100% by volume of the powder composition 11 a vitrified bond 2 in an amount of 25% to 60% by volume, based on 100% by volume of the powder composition 11, a gum arabic 3 in an amount of 5% to 20% by volume; preferably in an amount of 7% to 17% by volume; and more preferably in an amount of 8% to 12% by volume, based on 100% by volume of the powder composition 11, a pore forming material 4 in an amount of 0% to 20% by volume; preferably in an amount of 0% to 15% by volume, based on 100% by volume of the powder composition 11 and a secondary grit 5 in an amount of 0% to an amount sufficient to bring the powder composition to 100% by volume, is provided. The application in the first step A may for example be performed by weighting and mixing the primary grit 1, the vitrified bond 2, the gum arabic 3, the pore forming material 4 and the secondary grit 5 in a shaker mixer. The method can further comprise an exact weighing of each component of the powder composition.

[0056] Then, in a step B the powder composition 11 is portioned and formed into the green body 10. The forming process is preferably done by pressing of the powder composition. The portioning may for example be done by using a metering unit. The powder composition 11 can be filled in constant portions into containers. The filled containers can be taken and emptied in a mold for example manually. Then the powder composition can be semi-automatic bi-directional pressed with a specific pressure of 25 kN/cm^2 for example.

[0057] In a step C, which is the step of sintering the green body and thereby producing the grinding segment, the gum arabic 3 burns out of the at least one green body 10 such that the at least one grinding segment 20 is manufactured or provided. The at least one grinding segment 20 can be used for manufacturing the grinding wheel 30. The sintering can be conducted with an averaged heating rate of about 20°C to 120°C per hour, preferably about 50°C to 70°C per hour. The maximum sintering temperature is from 600°C to 1100°C.

[0058] Step C can be understood as an additional method step and is necessary for producing the grinding segment. For the method for manufacturing the green body steps A and B are essential.

[0059] A grinding segment called 29.5-3-B10-C60-R11-V1000 is depicted as a further exemplary embodiment concerning its production. The dimensions of the example segment with hexagonal shape are a wrench size of 29.5 mm with a thickness of 3 mm.

[0060] First step is to weigh all the ingredients according to following the recipe:

Table 1: Overview for green body, in particular grinding segment, called 29.5-3-B10-C60-R11-V1000

volume in [%]	weight for 1 piece in [g]	material identification	size wear necessary	supplier	remark	Density in [g/cm^3]
15.8	1.31	CBN-B	5-10 μm	Van Moppes	primary grit	3.48
9.3	0.66	aluminum oxide pink	600 mesh	Munk&Schmitz Oberflächentechnik GmbH&Co. KG	secondary grit	3.00

(continued)

volume in [%]	weight for 1 piece in [g]	material identification	size wear necessary	supplier	remark	Density in [g/cm^3]
27.4	1.95	aluminum oxide white	800 mesh	Erich, Theodor	secondary grit	3.00
36.8	2.10	DSCE K 2247 Transparent 1376714		Ferro	vitrified bond	2.40
10.7	0.31	temporary binder		Caesar & Loretz	gum arabic	1.22
100	6.33	total				

[0061] During the weighing process the single components multiplied by the actually needed number of pieces are added after each other into a mixing bottle, which subsequently is further treated in a mixing procedure with a tubular shaker mixer type T2F from Willy A. Bachofen AG Maschinenfabrik CH with a rotational speed of 60 rpm and a mixing duration of 4 hours. Every hour the bottle is tapped to avoid clumping in edges.

[0062] The next step is to homogenize the produced mixture via sieving with a sieve with a 0.2 mm mesh opening. The mixed and sieved raw material is afterwards portioned in a further step by a Dr. Fritsch weighing automat type DWA 11. In this kind of metering unit the powder composition is filled in constant portions into little cups on the rotary table. In this case a portion will have a weight of 6.33 grams which equates to the sum given in the table above. These single cups are filled in steel molds and pressed with 126.6 bar. After demolding the received green body is placed onto a with mesh 80 pink aluminum oxide covered cordierite plate from Steuler, which is placed into a sinter furnace ST 68 HD BW from PYROTEC. The sinter program in this case is as follows: heating with a heating rate of 60°C per hour onto 700°C and then maximum heating rate up to 880°C. This maximum temperature is held for one hour before the oven is cooled down again with maximum cooling rate.

[0063] After the sintering the grinding segment manufacturing is completed. It will be further machined and glued to a blank together with other grinding segments to build a whole grinding wheel.

[0064] In the foregoing detailed description, various features are grouped together in one or more examples or examples with the purpose of streamlining the disclosure. It is to be understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents. Many other examples will be apparent to one skilled in the art upon reviewing the above specification.

[0065] The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. In the appended claims and throughout the specification, the terms "having" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein," respectively. Furthermore, "a" or "one" does not exclude a plurality in the present case.

[0066] It can be considered that more and more lapping applications will be replaced by double disk grinding processes. In the double disk grinding process the workpieces are to be grinded between two grinding wheels. The grinding wheels are mostly in a horizontal position. The double disk grinding machines can be from the suppliers Lapmaster Wolters GmbH (Germany) or Stähli Läpp Technik AG (Switzerland). Thus, grinding wheels manufactured by using gum arabic is a promising method for the grinding technology with an ascending market share.

Claims

1. A green body (10), comprising
   a primary grit (1) in an amount of 5% to 40% by volume, based on 100% by volume of the green body (10);
   a vitrified bond (2) in an amount of 20% to 60% by volume, based on 100% by volume of the green body (10);
   a gum arabic (3) in an amount of 5% to 20% by volume, based on 100% by volume of the green body (10);
   a pore forming material (4) in an amount of 0% to 20% by volume, based on 100% by volume of the green body (10); and
   a secondary grit (5) in an amount of 0% to an amount sufficient to bring the green body (10) to 100% by volume.

2. The green body (10) of claim 1, wherein the primary grit (1) comprises super abrasive grits with a mean grit size from 2μm to 300μm.

3. The green body (10) of claim 1, wherein the vitrified bond (2) comprises at least one glass frit.

4. The green body (10) of claim 1, wherein the pore forming material (4) comprises graphite or glass bubbles.

5. The green body (10) of claim 1, wherein the secondary grit (5) comprises aluminum oxide, silicon carbide, boron carbide or boron nitride.

6. A method for manufacturing at least a green body (10), comprising the steps:

A) providing a powder composition (11), comprising
a primary grit (1) in an amount of 5% to 40% by volume, based on 100% by volume of the powder composition (11);
a vitrified bond (2) in an amount of 20% to 60% by volume, based on 100% by volume of the powder composition (11);
a gum arabic (3) in an amount of 5% to 20% by volume, based on 100% by volume of the powder composition (11);
a pore forming material (4) in an amount of 0% to 20% by volume, based on 100% by volume of the powder composition (11) and
a secondary grit (5) in an amount of 0% to an amount sufficient to bring the powder composition (11) to 100% by volume;
B) portioning and forming the powder composition (11) into the at least one green body (10).

7. The method of claim 6, wherein by sintering of the at least one green body (10) the gum arabic (3) burns out of the green body (10) such that at least a grinding segment (20) is provided.

8. The method of claim 6, wherein the powder composition (11) is provided by weighting and mixing the primary grit (1), the vitrified bond (2), the gum arabic (3), the pore forming material (4) and the secondary grit (5).

9. The method of claim 7, wherein the sintering is conducted with an averaged heating rate of about 20°C to 120°C per hour and a maximum sintering temperature of 600°C to 1100°C.

10. The method of claim 7, wherein the at least one grinding segment (20) is deburred with a tumble vibratory grinder.

11. The method of claim 7, wherein the at least one grinding segment (20) is cleaned via an ultrasonic bath.

12. A grinding wheel (30), produced by the method of any one of claims 6 to 11, wherein in a further step the at least one grinding segment (20) is positioned and glued onto a blank (6).

13. The grinding wheel of claim 12, wherein the at least one grinding segment (20) is glued by two component glue.

14. The grinding wheel of claim 12, wherein the blank (6) comprises steel, aluminum or stainless steel with a diameter between 120 mm and 1800 mm.

Fig. 1

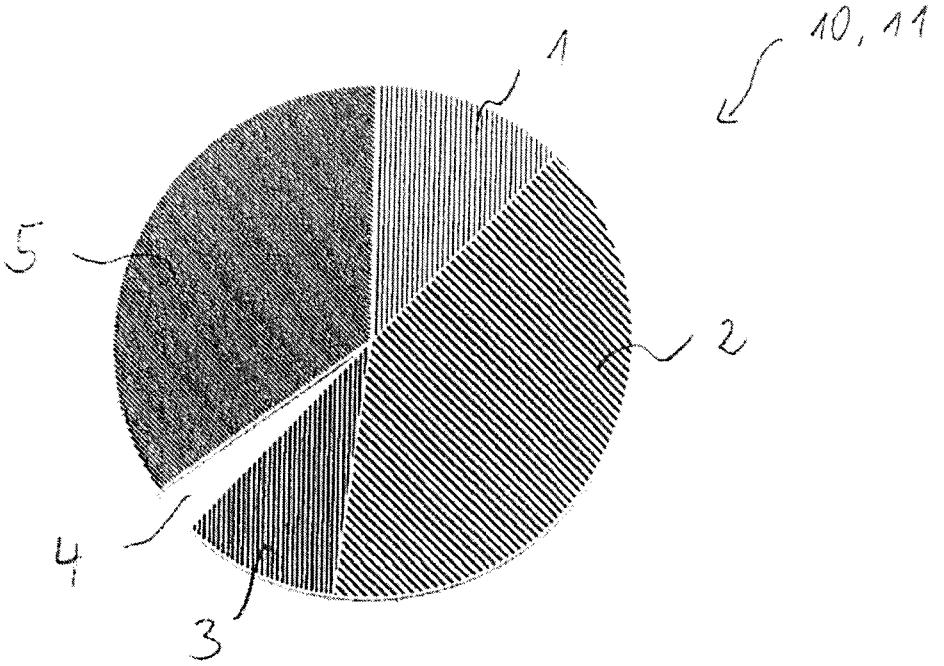


Fig. 2

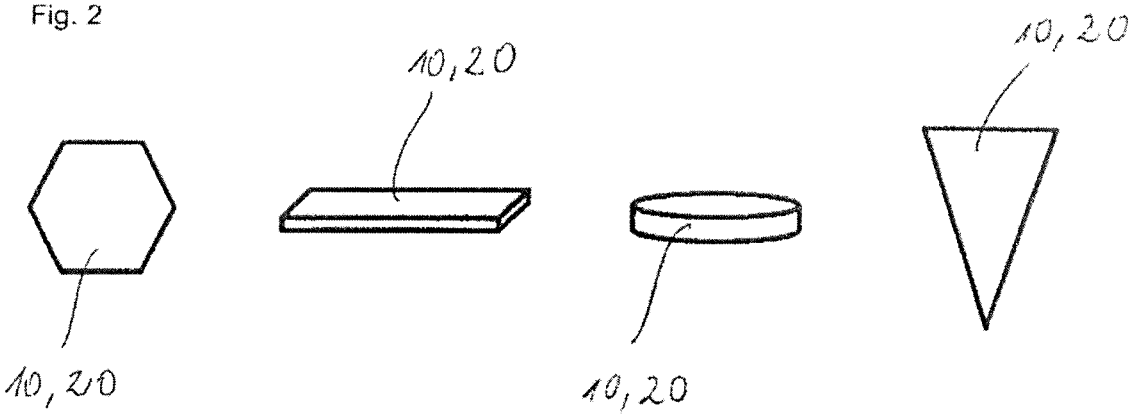


Fig. 3

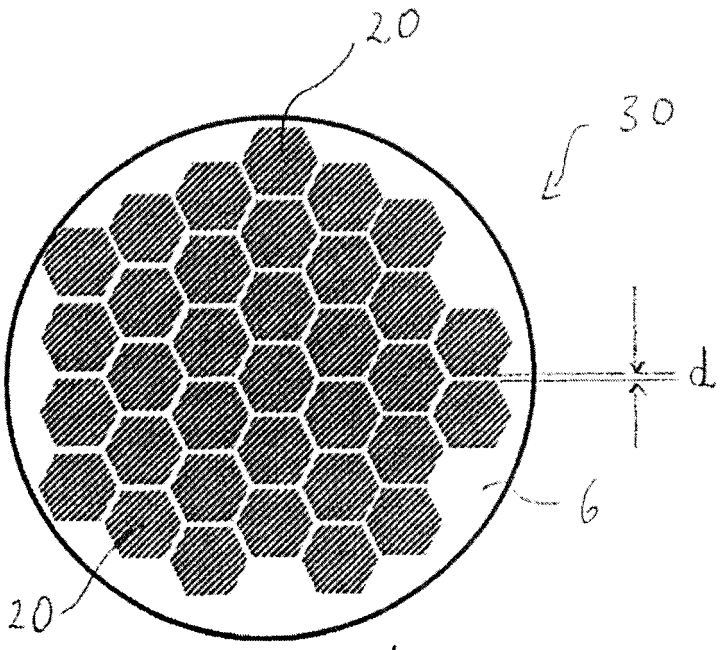


Fig. 4

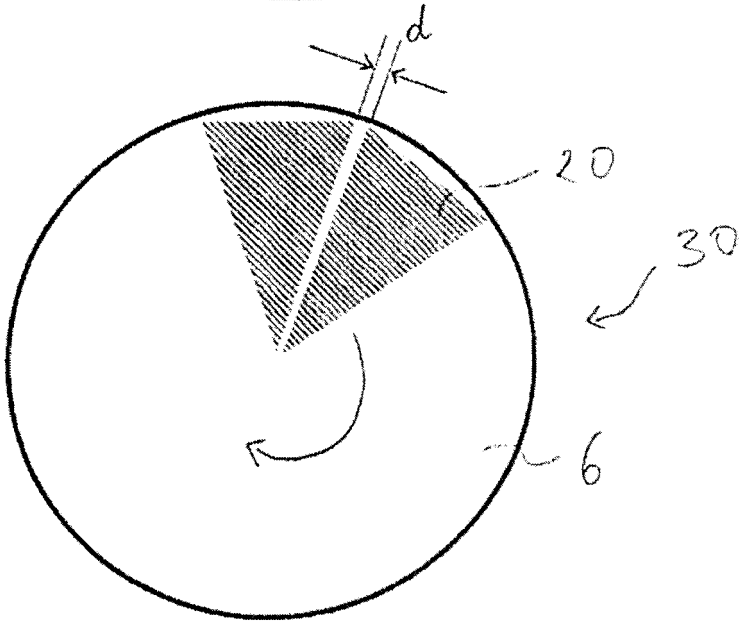
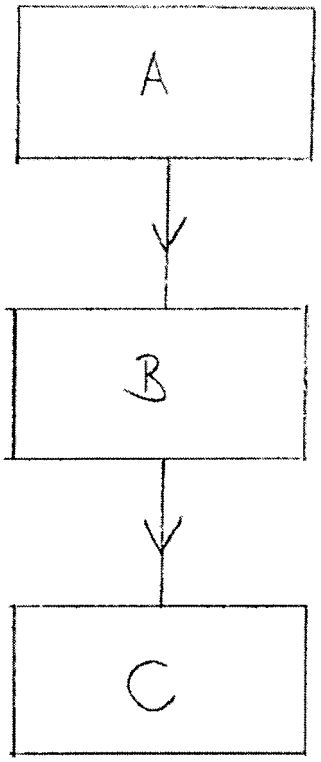


Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 8783

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The present search report has been drawn up for all claims

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