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(54) Title: MODIFIED CERAMIC FORMER FOR MANUFACTURING A NITRILE BUTADIENE RUBBER (NBR) ARTICLE HAVING IMPROVED GRIP PROPERTIES

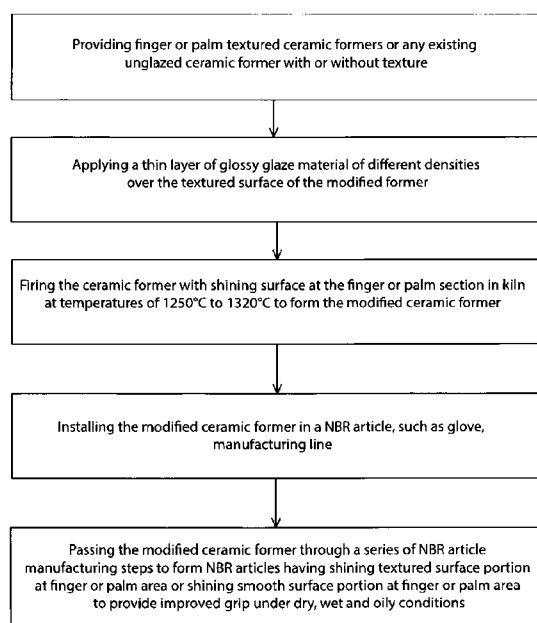


FIG. 1

(57) Abstract: A modified former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties includes a textured surface at finger or palm section of the modified former and a shining surface at the finger or palm section or both the finger and palm sections of the modified former. Sandblasting or spray on method produces the textured surface at the finger or palm section. Applying a thin layer of glossy glaze material with different densities over the unglazed textured surface followed by firing in kiln at suitable temperatures forms the modified ceramic former with the shining surface. The surface of the modified former made from ceramic materials is altered to form the shining surface at the finger or palm section or both the finger and palm sections to provide improved grip under dry, wet and oily conditions.

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**MODIFIED CERAMIC FORMER FOR MANUFACTURING A NITRILE BUTADIENE
RUBBER (NBR) ARTICLE HAVING IMPROVED GRIP PROPERTIES**

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FIELD OF INVENTION

The present invention relates generally to nitrile butadiene rubber articles, and more specifically, to a modified former for manufacturing nitrile butadiene rubber articles such as gloves with improved grip.

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BACKGROUND

Nitrile butadiene rubber articles such as glove, finger cots etc., have been widely used for many applications such as in medical field, industrial applications, etc. In many industries, employees are required to wear gloves to hold industrial articles and other tools. The tools may include a working portion and a handle portion that is adapted to be gripped by the hand of a user so that the working portion can be manipulated. The use of existing gloves for holding the tools may cause slippage of the tool or the article held by the user and can occur when the user applies excessive force to the article or when the user's grip on a portion of the tool or the article, such as the handle, loosens. Such slippage can seriously injure the user or others in the vicinity of the user or may cause malfunctioning or damage of associated equipment or device. Some hand-held articles or tools are adapted to reduce slippage in one direction or have a uniform surface pattern to reduce slippage equally in all directions without consideration of the direction of applied force. However, some designs are not well suited to adequately reduce slippage in multiple directions.

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Another use of the nitrile butadiene rubber articles such as glove, finger cots etc., is as a primary barrier protection against the spread of diseases in various situations, including direct medical care, surgery, dental care and food handling purposes. To glove users, the essential properties apart from protection are the comfort and ease of movement in performing their routine duties while gloves are being worn. Conventional non-textured gloves are manufactured with smooth surfaces that do not possess good tactile sense and non-slip qualities. These gloves become

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slippery when in use, more so when in contact with water or fluid. This causes strain and discomfort to the fingers and hands of the users since extra effort is required to maintain a sturdy grip of their equipment while using gloves. Users also experience less flexibility of hand and finger movement and reduced tactile sense that consequently affects the precision and accuracy of the duties.

There exist synthetic or natural latex gloves with enhanced gripping characteristics in the market, which provide slip-resisting, gripping action, even when wet articles are handled. The external surface of the glove can be textured in order to obtain superior gripping properties. Traditional approaches include the use of textured formers, which are dipped into an aqueous latex emulsion resulting in a textured glove surface at the textured former contact surface. When the glove is inverted, the external glove surface becomes textured with a pattern representative of that on the former. Generally, the former external surface can be textured or indented in each of the finger, thumb tips, and body portions so that gloves with texture in these regions can be produced. The details of the texture produced can vary according to the requirements of the glove manufacturer. Unfortunately, this simple approach has limited applications, since dipping defects occur at the edges defining the texture, resulting in a latex film, which has holes or which tears easily at these defective regions. The textured former surface also readily degrades, and latex articles are difficult to strip from the former after cross-linking of the latex film, due to the texture present at the former-latex interface. The stripping action might tear formed latex articles or in the worst case, produce pinholes and other defects, which may be difficult to observe but nevertheless deteriorate the overall quality and reliability of the latex product. Moreover the textured articles such as the textured glove available in the present market cannot be used in dry, wet and oily conditions with the same gripping properties. Some types of work gloves, such as the household gloves, existing in the market has its surfaces of the palms dotted with separate, raised beads of polymeric material, for the purpose of improving the grip of the glove. These polymer beads enhance the gripping property of the gloves. However these gloves are relatively hard and make the surface of the glove irregular.

US patent US 5,625,900 A entitled "High grip glove" issued to Specialty Sports Limited provides a glove in which at least the palm area is coated with a soft, somewhat tacky to the

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touch elastomer which gives the glove excellent gripping properties. The elastomer is preferably applied in a continuous, embossed pattern, and most preferably is applied to an underlying layer of synthetic leather, which in turn is secured to at least the palm area of the glove. The gloves of this patent are useful as snowmobile gloves, ski gloves, work gloves, etc. where economical increased gripping potential is desirable. However the use of this glove for other applications are not disclosed in the patent and the grip properties of these gloves may vary in dry, wet and oily conditions.

US patent application US 20110030121 A1 titled "Slip-resistant medical grip glove" filed by Delicia A. Smalls discloses an improved medical or surgical glove which features a variety of means of placing enhanced gripping textures and surfaces on the exterior of the glove. These textures and surfaces may be placed in a variety of locations upon the exterior surface of the glove. The glove may be constructed from any of a selection of resiliently flexible materials. The glove is of the type having four finger enclosures and four fingertips, a thumb enclosure and thumb tip, a hand portion with a palm surface and a backhand surface, and a wrist portion having an opening through which a user's hand is inserted. The disclosed glove features a variety of patterns of raised and/or textured sections on the exterior surface of the glove to provide enhanced gripping capability to a wearer. However the grip properties of the glove disclosed in the patent application may vary in dry, wet and oily conditions.

US patent US 7378043 B2 titled "Latex gloves and articles with geometrically defined surface texture providing enhanced grip and method for in-line processing thereof" issued to Ansell Healthcare Products Llc. discloses latex articles with geometrically defined surface structure providing enhanced grip characteristics in dry, wet or oily environment. The patent also discloses a method of making the glove, which includes the steps of applying a polymeric coagulant coating to a smooth former surface, wherein the coating becomes tacky during drying, applying discrete coagulant particles of selected size, shape and distribution to the tacky coating to attach and protrude from the former surface with the polymeric coagulant coating, dipping the former into an aqueous latex emulsion, wherein the polymeric coagulant coating and the discrete coagulating particles destabilize the latex, thereby developing a latex layer, vulcanizing and stripping the latex article inside out, and dissolving the discrete coagulant particles in water or

suitable solvents to reveal the geometrically designed texture with pre-selected size, shape and distribution of impressions providing improved dry, wet and oily surface grip by removal of a fluid boundary layer. However the above glove requires substantial changes to be made to the existing glove manufacturing line and complete glove manufacturing process.

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US patent US 7356852 B2 entitled "Latex glove with textured outer surface" issued to Supermax, Inc. discloses an ambidextrous, latex glove with a textured surface on the areas of the glove corresponding with the touch parts of fingers and a palm. The areas on a hand that are used for gripping and holding are covered with a textured latex surface, providing increased friction and for improved gripping. The surgical glove constructed from a latex material and having an opening includes an interior surface, an exterior surface, a palm section, a plurality of finger sections, a band, the band being located around the opening and being encased by the latex material, the band ensuring a proper fit and prevents the glove from rolling upwards and an embossed surface. The embossed surface extending from the interior surface to the exterior surface and having an interior side and exterior side, respectively, the embossed surface being a raised, geometric-textured surface disposed on at least 50% of the palm section and at least 20% of the finger sections, the raised, geometric-textured surface being formed from a plurality of geometric shapes that lie adjacent and touch each other, the interior side providing tactile sensitivity to a user and an exterior side providing a non-slip surface that inhibits water retention to a working surfaces. However the grip properties of the glove disclosed in the patent application may vary in dry, wet and oily conditions. Hence there exists a need for a NBR article having an improved grip property, which can be used in dry, wet and oily conditions, and would not need substantial changes to the manufacturing process.

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SUMMARY

The present invention is a modified ceramic former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties. The modified former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties includes a textured surface at finger or palm section or both the finger and palm section of the modified former and a shining surface at the finger or palm section of the modified former. Sandblasting or spray on method on

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the ceramic former produces the textured surface at the finger or palm section or both the finger and palm section of the former. Applying a thin layer of glossy glaze material with different densities over the unglazed textured surface of the ceramic former followed by firing in kiln at suitable temperatures forms the modified ceramic former with the shining surface. The surface of the modified former made from ceramic materials is altered to form the shining surface at the finger or palm section or both the finger and palm section to provide improved grip under dry, wet and oily conditions.

Other objects and advantages of the embodiments herein will become readily apparent from the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTIONS OF THE DRAWINGS

FIG. 1 illustrates steps for modifying a ceramic former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties, according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION

In the following detailed description, a reference is made to the accompanying drawings that form a part hereof, and in which the specific embodiments that may be practiced is shown by way of illustration. These embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and it is to be understood that the logical and other changes may be made without departing from the scope of the embodiments. The following detailed description is therefore not to be taken in a limiting sense.

Embodiments of the present invention disclose a modified ceramic former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties. **FIG. 1** illustrates a flowchart showing the steps for modifying a ceramic former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties, according to a preferred embodiment of the present invention. The present modified ceramic former improves the grip

properties of nitrile butadiene rubber (NBR) article, such as, but not limited to, gloves, finger cot, etc. manufactured using the modified ceramic former under dry, wet and oily conditions. The present method for improving the grip properties of nitrile butadiene rubber article employs the modified ceramic formers, which is formed by modifying existing finger or palm textured ceramic formers or any existing unglazed ceramic former with or without texture. The modified ceramic formers, according to the present invention, can be used in the NBR article manufacturing process to produce nitrile butadiene rubber article having a shining texture surface or shining smooth surface without the adjustment on latex formulation and dipping processes. The modified ceramic formers used in the present invention are formed by modifying finger or palm or both the finger and palm texture surfaces on the existing formers to have a shining surface portion. The modification also can be done on unglazed former without texture to have shining smooth surface portion. The present method for manufacturing nitrile butadiene rubber article having improved gripping properties follows similar manufacturing steps as used in existing nitrile butadiene rubber article manufacturing processes.

Referring to the flowchart shown in **FIG. 1**, the steps for modifying a ceramic former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties includes the step of providing unglazed ceramic former with or without texture. In some instances, the ceramic former for the manufacture of NBR article having improved grip properties is having a textured surface at finger or palm section or both the finger and palm sections of the modified former. Further the ceramic former is modified to provide a shining surface at the finger or palm section or both the finger and palm sections by applying a thin layer of glossy glaze material over the textured surface of the modified former. In case of an unglazed ceramic former without texture, sandblasting or spray on method produces the textured surface at the finger or palm section or both the finger and palm sections. Applying a thin layer of glossy glaze material with different densities over the unglazed textured surface of the modified ceramic former forms the shining surface. For an unglazed former without the textured surface, the glossy glaze material is applied on finger or palm section or both the sections. The surface of the modified former made from ceramic materials includes shining surfaces at the finger or palm section or both the finger and palm sections to provide improved grip under dry, wet and oily conditions. In an embodiment of the present invention, the density of the thin layer of glossy glaze material ranges

from 1.18 g/cm³ to 1.52 g/cm³, which is applied on an unglazed textured surface of the ceramic former. The modified former formed from ceramic materials with the shining surface at the finger or palm section or both the finger and palm sections is prepared for manufacturing the NBR article having improved grip properties by subjecting it to fire in kiln at temperatures of 1250°C to 1320°C.

A method for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties includes the steps of providing an unglazed ceramic former having a shining textured surface portion at finger or palm area or shining surface portion at finger or palm area or both the finger and palm sections. The shining surface at the finger or palm section or both the finger and palm sections of the modified former is produced by applying a thin layer of glossy glaze material of different densities over the textured surface of the modified former. The ceramic former with the shining surface at the finger or palm section or both the finger and palm sections is fired in kiln at temperatures of 1250°C to 1320°C to form the modified ceramic former for manufacturing NBR articles having improved grip properties. The modified ceramic former is then passed through a series of NBR article manufacturing steps, such as, dipping in an acid tank, followed by alkaline tank, water rinsing tank, coagulant and place in an oven to dry the coagulant and thereafter dip into a latex compound followed by placing it in the oven, then placing in a leaching tank oven for curing and passing through a cooling tank before stripping the NBR article. The NBR articles manufactured using the modified ceramic former having shining textured surface portion at finger or palm area or shining smooth surface portion at finger or palm area or both the finger and palm sections provide improved grip under dry, wet and oily conditions.

In certain embodiment of the present invention, the ceramic former installed at the NBR article manufacturing line, for manufacturing articles such as glove, has a shining surface from 1-3 knuckles of the finger section of the ceramic former. In some other embodiment, the ceramic former installed at the NBR article manufacturing line, for manufacturing articles such as glove, has a shining surface at any part of the glove, which may come into contact with a surface when a user holds the object. The modified ceramic former having the shining textured surface portion at finger or palm area or shining surface portion at finger or palm area or on both the finger and

palm sections can be installed at the existing NBR article manufacturing lines for manufacturing articles such as glove, which has a smooth or textured surface at the finger or palm area or on both the finger and palm sections of the glove to provide improved grip properties. In a yet another embodiment of the present invention, the ceramic former installed at the NBR article manufacturing line, for manufacturing articles such as glove, has shining surface at any part of the glove such as the palm area or fingers of the glove and have textured surface at one or more parts of the ceramic former or without texture. The NBR article produced using the present method has a different appearance as the NBR article 'shine' at the textured or smooth surface areas. For example, the gloves manufactured using the modified ceramic former having shining surface from 1-3 knuckles of the finger section will produce enhanced grip NBR gloves.

In a preferred embodiment of the present method, the ceramic former is modified by applying a thin layer of glossy glaze material with different density on to the surface of the ceramic former to form a shining surface portion. The glossy glaze material is a mix of natural minerals and synthetic materials containing B_2O_3 , Al_2O_3 , SiO_2 , K_2O , Na_2O , Li_2O , CaO , MgO , ZnO and ZrO_2 . The density of the thin layer of glossy glaze material ranges from 1.18 g/cm³ to 1.52 g/cm³ and is applied on an unglazed textured surface of the ceramic former or unglazed former without textured on 1-3 knuckles of former or palm area or for the whole former. The surface of the ceramic former is modified to provide a shining texture to a finger or palm area or both the finger and palm sections of the nitrile butadiene rubber (NBR) article. The nitrile butadiene rubber article having shining external surface is formed by the shining surface provided on the modified ceramic former at the finger or palm area or both the finger and palm areas, which provides improved grip under dry, wet and oily conditions. Sandblasting or spray on method followed by coating of shining glaze or spraying with shining glaze materials produces the shiny textured surface portion of the ceramic former for producing the nitrile butadiene rubber article. The ceramic former having the shining textured surface portion and the textured surface portion is dipped in a nitrile butadiene rubber solution, processed and stripped for manufacturing the nitrile butadiene rubber article including gloves. The present method employs modified ceramic former having shining texture on finger or palm section or both the finger and palm sections without the adjustment on latex formulation and dipping processes to manufacture the nitrile butadiene rubber article having improved grip.

In an embodiment, the modified ceramic former is used for manufacturing gloves having improved grip and the shining effect on the present glove surface gives the glove improved tacky properties. By using the present modified ceramic former, NBR glove with shining finger texture or shining finger part or shining palm textured or shining palm or smooth surface at any part of the glove, which may be with or without texture, is developed and has enhanced grip properties in dry, wet and oily conditions. In some other embodiment, the same tacky texture of the modified ceramic former used in the present method can be applied to unglazed palm textured (UGPT) gloves and glove without texture. Tackiness test is conducted on a group of male and female candidates using a tackiness gauge to get more accurate and more reliable results. The higher the angle getting from the test, the better is the grip properties. By comparing the NBR gloves described in this invention with current gloves in the market, the NBR gloves with shining textured is able to achieve higher angle till 100°, which showed improved grip properties.

The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the scope of the appended claims.

Although the embodiments herein are described with various specific embodiments, it will be obvious for a person skilled in the art to practice the invention with modifications. However, all such modifications are deemed to be within the scope of the claims.

WE CLAIM:

1. A modified former for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties comprises:

a textured surface at finger or palm section of the modified former; and

5 a shining surface at the finger or palm section or both the finger and palm sections of the modified former,

wherein the shining surface at the finger or palm section or both the finger and palm sections of the modified former is produced by applying a thin layer of glossy glaze material over the textured surface of the modified former;

10 characterized in that the surface of the modified former made from ceramic materials is altered to form the shining surface at the finger or palm section or both the finger and palm sections to provide improved grip under dry, wet and oily conditions.

2. The modified former of claim 1 wherein the shining surface at the finger or palm section or
15 both the finger and palm sections of the modified former is produced by sandblasting or spray on method followed by coating of shining glaze material or spraying with shining glaze materials,

wherein the shining surface is formed by coating of shining glaze material or spraying with shining glaze material with different densities over the unglazed textured surface of the modified ceramic former,

20 wherein the modified former formed from ceramic materials with the shining glaze material coating at the finger or palm section or both the finger and palm sections is fired in kiln at temperatures of 1250°C to 1320°C.

3. The modified former of claim 1 wherein the density of the thin layer of glossy glaze
25 material ranges from 1.18 g/cm³ to 1.52 g/cm³ is applied on an unglazed textured surface of the ceramic former.

4. A method for manufacturing a nitrile butadiene rubber (NBR) article having improved grip properties comprising the steps of:

providing an unglazed ceramic former having a shining textured surface portion at finger or palm area or shining surface portion at finger or palm area or both the finger and palm sections,

wherein the shining surface at the finger or palm section or both the finger and palm sections of the modified former is produced by applying a thin layer of glossy glaze material of different densities over the textured surface of the modified former,

wherein the ceramic former with the shining surface at the finger or palm section or both the finger and palm sections is fired in kiln to form the modified ceramic former for manufacturing NBR articles having improved grip properties; and

passing the modified ceramic former through a series of NBR article manufacturing steps; characterized in that the NBR articles manufactured using the modified ceramic former having shining textured surface portion at finger or palm area or shining smooth surface portion at finger or palm area or both the finger and palm sections provide improved grip under dry, wet and oily conditions.

5. The method of claim 4 wherein the ceramic former is applied with a thin layer of glossy glaze material with different densities on to the surface of the ceramic former to form a smooth surface portion,

wherein the glossy glaze material is a mix of natural minerals and synthetic materials containing B₂O₃, Al₂O₃, SiO₂, K₂O, Na₂O, Li₂O, CaO, MgO, ZnO and ZrO₂,

wherein the density of the thin layer of glossy glaze material range from 1.18 g/cm³ to 1.52 g/cm³ is applied on an unglazed textured surface of the ceramic former.

6. The method of claim 4 wherein the shining surface portion of the ceramic former for producing the nitrile butadiene rubber article is produced by sandblasting or spray on method followed by coating shining glaze material or spraying with shining glaze materials.

7. The method of claim 4 wherein the ceramic former with the textured or smooth surface coated with glossy glaze material to form shining surface at the finger or palm section or both the finger and palm sections is fired in kiln at temperature of 1250°C to 1320°C for producing the

shining surface on the ceramic former for manufacturing of NBR articles having improved grip properties.

8. The method of claim 4 wherein the nitrile butadiene rubber article having the shining external surface is formed by the shining surface provided on the ceramic former at the finger or palm area or both the finger and palm sections,

wherein the nitrile butadiene rubber article further includes a textured surface,

wherein the nitrile butadiene rubber article having the shining external surface and the textured surface provides improved grip under dry, wet and oily conditions.

9. The method of claim 4 wherein the ceramic former having the shining surface or shining textured portion and the textured surface portion is dipped in a nitrile butadiene rubber solution, processed and stripped for manufacturing at least one nitrile butadiene rubber article including gloves.

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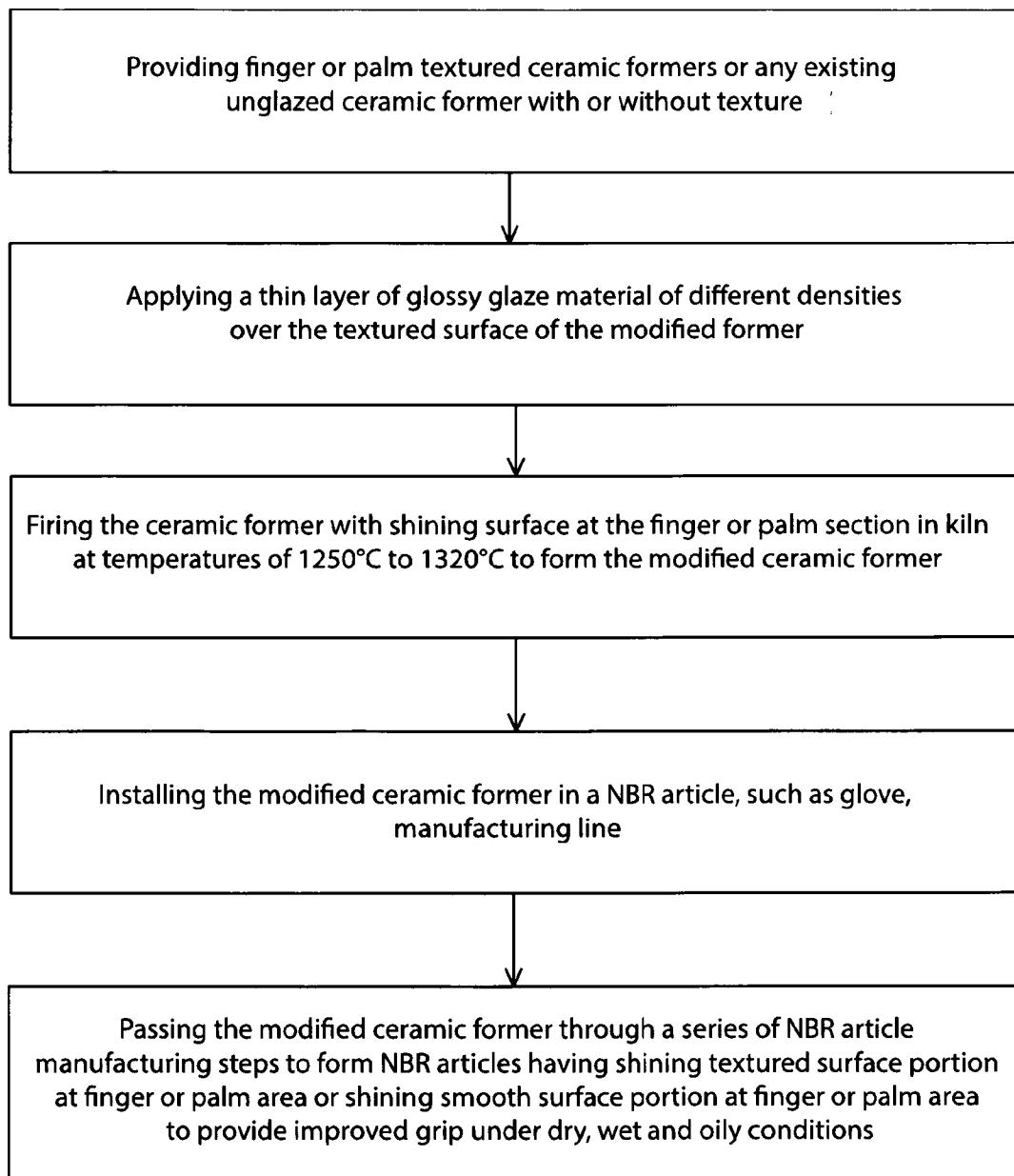


FIG. 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2017/000014

A. CLASSIFICATION OF SUBJECT MATTER INV. B29C41/14 B29C41/40 C04B41/86 C04B33/34 A41D19/015 A41D19/00 ADD. According to International Patent Classification (IPC) or to both national classification and IPC																							
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) B29C B29K C04B B29L A41D B24C 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 <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>EP 0 637 571 A2 (HOECHST CERAM TEC AG [DE]) 8 February 1995 (1995-02-08)</td> <td>1-4,6-9</td> </tr> <tr> <td>Y</td> <td>page 5 - page 7; claims 1, 2, 11; examples 1-9 page 2 - page 3, line 7</td> <td>1-9</td> </tr> <tr> <td>X</td> <td>JP 2005 104737 A (SHINKO KK) 21 April 2005 (2005-04-21)</td> <td>1-4,6-9</td> </tr> <tr> <td>Y</td> <td>abstract; figures 1-3 paragraphs [0009] - [0011], [0013], [0016] paragraphs [0018] - [0022]</td> <td>1-9</td> </tr> <tr> <td>Y</td> <td>US 7 356 852 B2 (SUPERMAX INC [US]) 15 April 2008 (2008-04-15) cited in the application column 2, last paragraph; figure 3 column 2, line 33 - line 50</td> <td>1-9</td> </tr> <tr> <td></td> <td>-/--</td> <td></td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	EP 0 637 571 A2 (HOECHST CERAM TEC AG [DE]) 8 February 1995 (1995-02-08)	1-4,6-9	Y	page 5 - page 7; claims 1, 2, 11; examples 1-9 page 2 - page 3, line 7	1-9	X	JP 2005 104737 A (SHINKO KK) 21 April 2005 (2005-04-21)	1-4,6-9	Y	abstract; figures 1-3 paragraphs [0009] - [0011], [0013], [0016] paragraphs [0018] - [0022]	1-9	Y	US 7 356 852 B2 (SUPERMAX INC [US]) 15 April 2008 (2008-04-15) cited in the application column 2, last paragraph; figure 3 column 2, line 33 - line 50	1-9		-/--	
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																							
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INTERNATIONAL SEARCH REPORT

International application No

PCT/MY2017/000014

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