



- (51) **International Patent Classification:**
B32B 37/14 (2006.01) *B32B 37/30* (2006.01)
- (21) **International Application Number:**
PCT/IB2016/056785
- (22) **International Filing Date:**
11 November 2016 (11.11.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
P201531882 22 December 2015 (22.12.2015) ES
- (71) **Applicant:** BSH HAUSGERÄTE GMBH [DE/DE]; Carl-Wery-Str. 34, 81739 München (DE).
- (72) **Inventors:** ALAMAN AGUILAR, Jorge; Madre Vedruna 6, 4^oD, 50008 Zaragoza (ES). ALICANTE SANTIAGO, Raquel; P^o Fernando el Católico 41, 4^o1^a, 50006 Zaragoza (ES). ALONSO LOZANO, Sergio; C/ Fernando el Católico 61, esc. Dcha. 3^oA, 50006 Zaragoza (ES). ESTER SOLA, Francisco Javier; San Jorge, 33-Esc. Dcha.-7^oDcha, 50001 Zaragoza (ES). GIMENO ASIN, Carlos; Salvador Allende 16, 50015 Zaragoza (ES). GIMENO ASIN, Manuel; Avenida Salvador Allende n^o 16, 50015 Zaragoza (ES). SANCHEZ SOMOLINOS, Carlos; Avenida de Madrid, 50010 Zaragoza (ES).

(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) **Title:** PROCESS FOR MANUFACTURING A HOUSEHOLD APPLIANCE COMPONENT

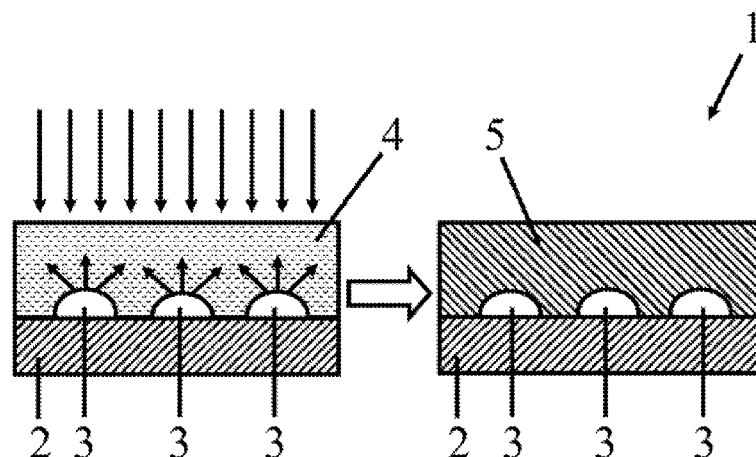


Fig. 1

(57) **Abstract:** The invention relates to a process for manufacturing a household appliance component (1). The process comprises the steps of providing a base element (2), generating a light guide structure (3) on the base element (2), coating at least a part of the light guide structure (3) with an UV-curable composition (4), and at least partially curing the composition (4) by coupling-in UV light into the light guide structure (3), transmitting said UV light through the light guide structure (3) to the composition, and coupling-out said UV light into the composition (4). The invention further relates to a household appliance component (1), comprising a base element (2), which at least in parts comprises at least one layer (5) made from a UV-curable composition (4), and to a household appliance comprising at least one household appliance component (1).

PROCESS FOR MANUFACTURING A HOUSEHOLD APPLIANCE COMPONENT

The invention relates to a process for manufacturing a household appliance component. The invention further relates to a household appliance component, comprising a base element, which at least in parts comprises at least one layer made from a UV-curable composition. Still further, the invention relates to a household appliance comprising at least one household appliance component.

Household appliance components comprise a base element or substrate, which is frequently equipped with a coating in order to provide certain optical or functional properties. Such coatings can for example be used to generate surface areas with certain colours and shapes, to achieve different opacities, or to create textures. Further, conductive materials, tensoactive materials, protective films, varnishes and the like may be applied as a coating to the base element, depending on the intended purpose of the household appliance component.

However, the thickness of these coatings or layers is a key factor for decorative coatings as well as for functional coatings. It is thus necessary to adjust the thickness of the coating or layer. For most applications, thick layers are important, for example for protective coatings. The thicker the coating or layer, the better the protection.

In order to provide the base element with a coating, UV-curable compositions are generally used for most applications. UV-curable coatings polymerize when they are exposed to light containing wavelengths in the UV spectrum (approx. 380 nm to 100 nm). In the curing process the composition hardens, achieves its final properties and adheres to the substrate or base element.

One limitation of this technology is that the UV light has to reach the interphase "composition – base element." If the UV light cannot reach the interface between the composition and the base element, this part of the composition is not or at least not sufficiently cured. This leads to bad adhesion and poor properties of the resulting coating

or layer. Therefore the maximum layer thickness is limited in order to ensure that UV light can reach the interface between the coating and the base element.

Presently, the only way to avoid this problem is by repeatedly coating and curing several thin layers. Depending on the required thickness of the coating, many cycles are necessary, which leads to a slow and expensive production process. In addition, UV-curable compositions usually have a limited adhesion on already cured layers, which also leads to rather poor layer properties.

Another technical solution comprises repeatedly coating, but only partially curing the individual layers. This solution, however, requires additional UV lamps with lower power in order to only partially cure the compositions. Further, a compromise has to be found between total curing on the one hand and no or insufficient curing on the other hand. Further it has to be ensured that the final layer system still is entirely or at least sufficiently cured. This also leads to high process costs and complicates the production process.

It is the task of the present invention to provide a process for manufacturing a household appliance component, which allows the creation of UV-cured coatings with improved adhesion even at high layer thicknesses. A further task of the invention is to provide a household appliance component comprising a base element, which at least in parts comprises at least one UV-cured coating with improved adhesion even at high layer thicknesses. A further task of the present invention is to provide a household appliance comprising such a household appliance component.

These tasks are solved by a process according to claim 1 for manufacturing a household appliance component, a household appliance component according to claim 10, and a household appliance having the features of claim 14, wherein advantageous developments of the process are to be regarded as advantageous developments of the household appliance component and the household appliance and vice versa.

A first aspect of the invention relates to a process for manufacturing a household appliance component. According to the invention, the process comprises at least the steps of providing a base element, generating a light guide structure on the base element, coating at least a part of the light guide structure with an UV-curable composition and at

least partially curing the composition by coupling-in UV light into the light guide structure, transmitting said UV light through the light guide structure to the composition, and coupling-out said UV light into the composition. The invention is based on the idea to generate light guiding paths on the base element in a first step and apply the UV-curable composition onto at least a part of the light guiding paths or structure in a second step. The light guide structure then couples-in UV light, transmits the UV light to the composition, and releases or couples out the UV light into the composition, thus curing the coating from the inside, i.e. directly in the interphase region "composition – base element." This makes it possible to coat very thick layers in one step without deteriorating or worsening the coating's adhesion to the base element. By arranging the UV-curable composition directly on top of the light guide structure, a very compact assembly with high quantum efficiency can be established. It may generally also be provided that certain steps of the process are repeated once or several times in order to generate a stacked light guide - layer structure.

In an advantageous development of the invention it is provided that the light guide structure and/or the UV-curable composition are deposited by at least one coating method on the base element, in particular by at least one of spin coating, spray coating, dip coating, serigraphy, and inkjet printing. The light guide structure and/or the UV-curable composition in other words is or are formed as a layer or coating and are deposited or generated by one or more of the above-mentioned methods. Spin coating, dip coating, or serigraphy can for example be advantageously used if a rather large portion of the surface or the entire surface of the base element should be provided with light guiding abilities. On the other hand, inkjet printing can be also used to generate the light guiding layer in a very flexible way by controlled and selected deposition of respective light guiding material in order to guide light along a specific path. Inkjet printing or coating allows for a fast and easy recreation of complex geometries by propelling droplets of a suitable ink onto the surface of the base element of the household appliance component. Also, inkjet printing can be used to precisely adjust the thickness and/or formulation of the UV-curable composition and thus of the resulting coating, optionally even in a location-dependent manner.

In a further advantageous development of the invention it is provided that the light guide structure is generated in the form of a mesh on the base element. Although the light guide

structure may generally be designed in any suitable form, the form of a mesh, in particular a rectangular mesh, has the advantage that the UV light can be distributed and coupled-out particularly uniformly into the composition. This leads to a correspondingly uniformly hardened coating with good adherence to the base material.

In a further advantageous development of the invention it is provided that UV light is coupled into at least two or more locations of the light guide structure, in particular into two or more locations spaced around a circumference of the light guide structure. This allows UV light to couple into the light guide structure at different locations. Since the intensity of the coupled-in UV light decreases according to the length and optical characteristics of the light guide structure, the coupling-in at two or more locations allows a more uniform curing of extensive coatings.

In a further advantageous development of the invention it is provided that a surface of the UV-curable composition, which is opposite to the base material, is irradiated with UV light. It is in other words provided that the UV-curable composition is not only irradiated from the inside via the light guide structure, but also from the outside in order to fully cure the composition even if the coating has a very high layer thickness.

In a further advantageous development of the invention it is provided that the light guide structure has a higher refractive index than the base element and/or that the light guide structure is at least partly arranged on a cladding layer and/or at least partly arranged between two cladding layers and/or at least partly embedded in the cladding layer. If the light guide structure has a higher refractive index than adjacent material along its waveguide path, particularly good light guiding properties are achieved. The refractive indices of the light guide and the adjacent material are generally measured at a wavelength of 633 nm and at a temperature of 20 °C. If the light guide structure is deposited over or in contact with a base element made of ceramic glass, which is used for cooktop surfaces, the refractive index n of the light guide structure is for example chosen to be higher than approximately 1.54 ($n_{\text{glass}}=1.54$ at 633 nm). An additional cladding layer can advantageously be used to decrease and/or increase the refractive index of the adjacent material of the light guide structure in order to improve its light guiding properties. For example, the refractive index of a base element made of glass cannot be easily changed or decreased but, by using a cladding layer as an intermediate layer between a

base element made out of glass and the light guide structure with a relatively lower refractive index, suitable pairs of refractive indices are ensured. The light guide structure may be deposited or generated on top of the cladding layer so that the adjacent materials will have a lower refractive index than the light guide structure so that coupled-in light can be transmitted without relevant losses. The cladding layer can generally at least in parts consist of a hybrid polymer.

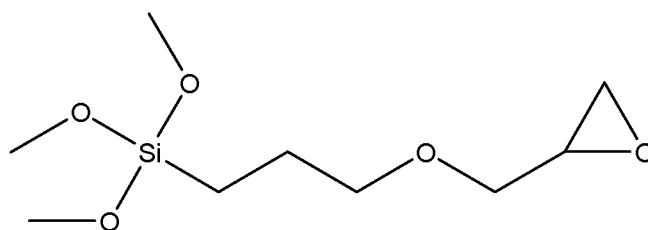
In a further advantageous development of the invention it is provided that at least one hybrid polymer is used to generate the light guide structure. Transparency is to be regarded as the physical property of allowing light to pass through the material without being substantially scattered. This allows for a very flexible, discrete, and unobtrusive embodiment of the light guide structure. Hybrid polymers are to be understood as polymeric materials which combine structural units of different classes of materials at the molecular level. Hybrid polymers may thus have very flexible properties and can be adjusted in an optimum manner to the respective embodiment of the household appliance component. In contrast to composite materials, which are defined by phase boundaries and weak interactions between the phases, the structural units of hybrid polymers are linked at the molecular level and can comprise inorganic and organic structural elements. This may be achieved by chemical methods such as sol-gel reactions. Hybrid polymers extend the scope of classical composite materials and are the basis for a required multifunctionality of materials.

In a further advantageous development of the invention it is provided that the hybrid polymer comprises by weight:

- 1-99 % 3-glycidyloxypropyltrimethoxysilane (GLYMO)
- 0-5 % photoacid generator, in particular a triarylsulphonium salt
- 0-2 % surfactant, in particular BYK-333
- 0-70 % refractive index increasing compound, in particular SU8 and/or diphenyl dimethoxysilane
- 0-10 % additive.

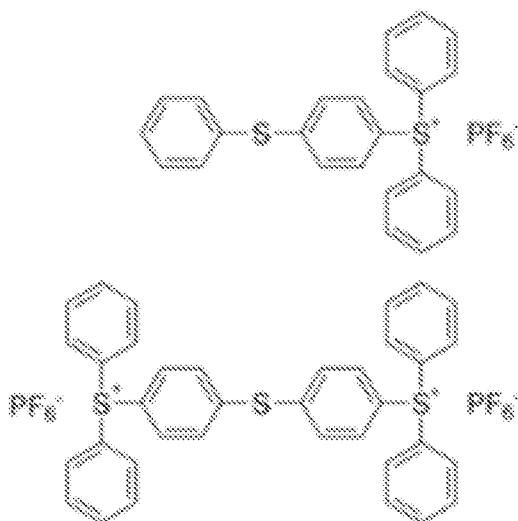
A weight fraction of 1-99 % in this connection includes values of 1 %, 2 %, 3 %, 4 %, 5 %, 6 %, 7 %, 8 %, 9 %, 10 %, 11 %, 12 %, 13 %, 14 %, 15 %, 16 %, 17 %, 18 %, 19 %, 20 %, 21 %, 22 %, 23 %, 24 %, 25 %, 26 %, 27 %, 28 %, 29 %, 30 %, 31 %, 32 %, 33 %, 34 %, 35 %, 36 %, 37 %, 38 %, 39 %, 40 %, 41 %, 42 %, 43 %, 44 %, 45 %, 46 %, 47 %, 48

%, 49 %, 50 %, 51 %, 52 %, 53 %, 54 %, 55 %, 56 %, 57 %, 58 %, 59 %, 60 %, 61 %, 62 %, 63 %, 64 %, 65 %, 66 %, 67 %, 68 %, 69 %, 70 %, 71 %, 72 %, 73 %, 74 %, 75 %, 76 %, 77 %, 78 %, 79 %, 80 %, 81 %, 82 %, 83 %, 84 %, 85 %, 86 %, 87 %, 88 %, 89 %, 90 %, 91 %, 92 %, 93 %, 94 %, 95 %, 96 %, 97 %, 98 %, and 99 % as well as respective intermediate values. The same applies correspondingly to weight fractions of 0-70 %. Correspondingly, weight fractions of 0-5 % include values of 0.0 %, 0.1 %, 0.2 %, 0.3 %, 0.4 %, 0.5 %, 0.6 %, 0.7 %, 0.8 %, 0.9 %, 1.0 %, 1.1 %, 1.2 %, 1.3 %, 1.4 %, 1.5 %, 1.6 %, 1.7 %, 1.8 %, 1.9 %, 2.0 %, 2.0 %, 2.1 %, 2.2 %, 2.3 %, 2.4 %, 2.5 %, 2.6 %, 2.7 %, 2.8 %, 2.9 %, 3.0 %, 3.1 %, 3.2 %, 3.3 %, 3.4 %, 3.5 %, 3.6 %, 3.7 %, 3.8 %, 3.9 %, 4.0 %, 4.1 %, 4.2 %, 4.3 %, 4.4 %, 4.5 %, 4.6 %, 4.7 %, 4.8 %, 4.9 %, and 5.0 % as well as respective intermediate values such as for example 0.01 %, 0.02 %, 0.03 %, 0.04 %, 0.05 %, 0.06 %, 0.07 %, 0.08 %, 0.09 %, 0.10 % and so on. Weight fractions of 0 to 10% consequently may additionally include values of 2.1 %, 2.2 %, 2.3 %, 2.4 %, 2.5 %, 2.6 %, 2.7 %, 2.8 %, 2.9 %, 3.0 %, 3.1 %, 3.2 %, 3.3 %, 3.4 %, 3.5 %, 3.6 %, 3.7 %, 3.8 %, 3.9 %, 4.0 %, 4.1 %, 4.2 %, 4.3 %, 4.4 %, 4.5 %, 4.6 %, 4.7 %, 4.8 %, 4.9 %, 5.0 %, 5.1 %, 5.2 %, 5.3 %, 5.4 %, 5.5 %, 5.6 %, 5.7 %, 5.8 %, 5.9 %, 6.0 %, 6.1 %, 6.2 %, 6.3 %, 6.4 %, 6.5 %, 6.6 %, 6.7 %, 6.8 %, 6.9 %, 7.0 %, 7.1 %, 7.2 %, 7.3 %, 7.4 %, 7.5 %, 7.6 %, 7.7 %, 7.8 %, 7.9 %, 8.0 %, 8.1 %, 8.2 %, 8.3 %, 8.4 %, 8.5 %, 8.6 %, 8.7 %, 8.8 %, 8.9 %, 9.0 %, 9.1 %, 9.2 %, 9.3 %, 9.4 %, 9.5 %, 9.6 %, 9.7 %, 9.8 %, 9.9 %, or 10.0 % as well as respective intermediate values. It goes without saying that the weight fractions of all components of the hybrid polymer always add up to 100 %. The presence of the epoxy group in the GLYMO, having the formula

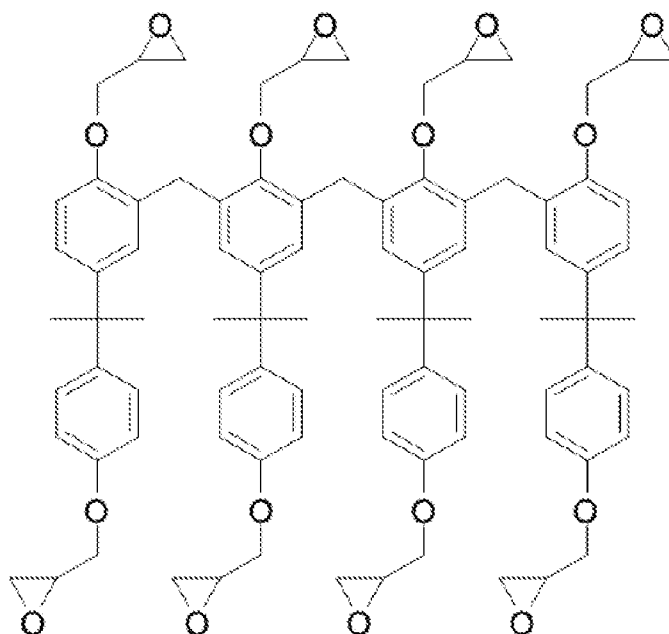


offers fast curing properties, while the silane group provides excellent adhesion properties on different base elements, especially base elements made of glass. Further, the hybrid polymer has a high resistance against extreme chemical and thermal conditions. The hybrid polymer may therefore be advantageously used in many different ways and embodiments. It can for example be used as a base ink due to its hybrid properties. By

using a certain weight fraction of the photoacid generator (PAG), a curing process in one step is possible by applying UV light to the hybrid polymer mixture. In this case, the GLYMO reacts with the photoacid generator or photoinitiator since acid is generated so that both processes, polymerization of the epoxy groups and hydrolysis and condensation of the silanes, are initiated at the same time. Therefore, organic/inorganic networks and coatings can be created by curing the hybrid polymer with UV light. The photoacid generator may comprise or be triarylsulphonium hexafluorophosphate salt having the formula



In order to adjust the rheological properties of the hybrid polymer mixture, between 0-2 %, in particular between 0.05-0.1 % of a surfactant can be used. An example of a suitable surfactant is BYK-333 (silicone-containing surface additive for surface tension reduction) from Altana AG. Other surfactants can generally be used as well. In order to increase the refractive index of the hybrid polymer, one or more refractive index increasing compounds can be added to the formulation such as for example SU8, an epoxy oligomer having the formula



The use of SU8 helps to increase the refractive index without negative impact on the mechanical properties of the hybrid polymer. For example, the refractive index of the hybrid polymer can be adjusted between approximately 1.5 and approximately 1.57 (at 633 nm) by adding from 0% to 70% of SU8, in particular between 0-25%. Apart from SU8, also other materials such as diphenyl dimethoxysilane (DPDMS) can be used in weight fractions ranging between 0% and 70%, preferably between 0-25%, in order to adjust and increase the refractive index and, due to its inorganic component, maintain the mechanical properties of the hybrid polymer. Alternatively or additionally, other refractive index increasing compounds can be used as well. Generally speaking, the presence of ring structures and/or sulphur atoms increases the refractive index of a chemical compound so that the number of ring structures and/or sulphur atoms can be used to adjust the desired refractive index. The hybrid polymer may thus for example consist of GLYMO, SU8, DPDMS, BYK-333, and PAG. Also, depending on the particular needs, one or more additives can be added to modify the properties of the hybrid polymer. The mixture of the educts of the hybrid polymer is preferably formulated in such a way that the rheological properties of the mixture allow its deposition by inkjet printing and/or by other coating methods. Thus, the mixture of the educts or the hybrid polymer can also be denoted an ink.

In a further advantageous development of the invention it is provided that the UV-curable composition is coated with a layer thickness of at least 20 μm , in particular of at least 30 μm . Thus, comparatively thick coatings can be generated in one pass. The layer thickness of the composition or the resulting coating can for example be 20 μm , 21 μm , 22 μm , 23 μm , 24 μm , 25 μm , 26 μm , 27 μm , 28 μm , 29 μm , 30 μm , 31 μm , 32 μm , 33 μm , 34 μm , 35 μm , 36 μm , 37 μm , 38 μm , 39 μm , 40 μm , 41 μm , 42 μm , 43 μm , 44 μm , 45 μm , 46 μm , 47 μm , 48 μm , 49 μm , 50 μm , 51 μm , 52 μm , 53 μm , 54 μm , 55 μm , 56 μm , 57 μm , 58 μm , 59 μm , 60 μm , 61 μm , 62 μm , 63 μm , 64 μm , 65 μm , 66 μm , 67 μm , 68 μm , 69 μm , 70 μm , 71 μm , 72 μm , 73 μm , 74 μm , 75 μm , 76 μm , 77 μm , 78 μm , 79 μm , 80 μm , 81 μm , 82 μm , 83 μm , 84 μm , 85 μm , 86 μm , 87 μm , 88 μm , 89 μm , 90 μm , 91 μm , 92 μm , 93 μm , 94 μm , 95 μm , 96 μm , 97 μm , 98 μm , 99 μm , 100 μm , 101 μm , 102 μm , 103 μm , 104 μm , 105 μm , 106 μm , 107 μm , 108 μm , 109 μm , 110 μm , 111 μm , 112 μm , 113 μm , 114 μm , 115 μm , 116 μm , 117 μm , 118 μm , 119 μm , 120 μm , 121 μm , 122 μm , 123 μm , 124 μm , 125 μm , 126 μm , 127 μm , 128 μm , 129 μm , 130 μm , 131 μm , 132 μm , 133 μm , 134 μm , 135 μm , 136 μm , 137 μm , 138 μm , 139 μm , 140 μm , 141 μm , 142 μm , 143 μm , 144 μm , 145 μm , 146 μm , 147 μm , 148 μm , 149 μm , 150 μm or more.

A second aspect of the invention relates to a household appliance component, comprising a base element, which at least in parts comprises at least one layer made from a UV-curable composition. An improved adhesion of the layer even at high layer thicknesses is according to the invention provided in that a light guide structure, which is configured to couple-in UV light into the light guide structure, transmit said UV light through the light guide structure to the layer, and couple-out said UV light to the layer, is arranged between the base element and the layer. The invention is based on the idea to provide light guiding paths between the base element and the UV-curable or UV-cured layer. The light guide structure is configured to couple-in UV light, transmit the UV light to the layer or coating, and release or couple out the UV light to the layer, thus ensuring a complete curing of the layer at least on the inside, i.e. directly in the interphase region "layer – base element." This makes it possible to have a very thick layer without deteriorating or worsening the layer's adhesion to the base element.

In an advantageous development of the invention it is provided that a thickness of the layer is between 20 μm and 150 μm . Thus, comparatively thick and homogeneous coatings that consist of a single layer instead of several stacked layers can be provided.

In a further advantageous development of the invention it is provided that the base element at least in parts consists of glass and/or plastic and/or stainless steel and/or aluminum. This allows a very flexible design of the household appliance component so that it can be optimally adapted to different operation purposes.

According to a further advantageous development of the invention, the household appliance component is manufactured by a process according to the first aspect of the invention. The resulting features and their advantages can be gathered from the above-given description.

A third aspect of the invention relates to a household appliance comprising at least one household appliance component, which is manufactured by a process according to the first aspect of the invention and/or configured according to the second aspect of the invention. The resulting features and their advantages can be gathered from the description of the first and second aspect of the invention.

It may further be envisaged that the household appliance is configured as a cooker, a cooking field, an oven, a microwave oven, a dishwasher, a dryer, a washing machine, a freezer, and/or a steam oven.

Further features of the invention derive from the claims as well as based on the following embodiments. The features and feature combinations mentioned above in the description as well as the features and feature combinations mentioned below in the embodiments are usable not only in the respectively specified combination, but also in other combinations without departing from the scope of the invention. There are thus also variations of the invention possible that are not explicitly shown and described in the embodiments but can be formulated through different combinations of separated features from the described embodiments. Also variations and combinations of features are possible that do not contain all the features of an originally formulated independent claim.

In the following, embodiments of the invention are shown in more detail by referring to schematic drawings. These show in:

Fig. 1 a schematic representation of a process for manufacturing a household appliance component;

Fig. 2 a schematic top view of a base element with a light guide structure;

Fig. 3 a schematic top view of the base element, wherein a part of the light guide structure is coated with an UV-curable composition; and

Fig. 4 a schematic sectional view of the coated base element.

Fig. 1 shows a schematic representation of a process for manufacturing a household appliance component 1 and will be discussed in synopsis with Fig. 2 to Fig. 4. In a first step of the process, a base element 2 is provided as a substrate. The base element 2, which may for example consist of ceramic glass, is then coated with a light guiding material in order to form a light guide structure 3 on the base element 2. Since the base material 2 has a refractive index around 1.5 at 633 nm it cannot work as a light guide by itself. The coating step may be performed for example by inkjet printing or other suitable coating methods of the light guiding material. The light guiding material may also be UV-curable.

Fig. 2 shows a schematic top view of the base element 2 and the resulting light guide structure 3. In the present embodiment, the light guide structure 3 has the form of a rectangular mesh in order to ensure uniform optical properties. Other geometric designs are of course also possible. In a next step, a part of the light guide structure 3 is coated with an UV-curable composition 4. This coating step can also be performed by inkjet printing or other suitable coating methods. To further illustrate this step, Fig. 3 shows a schematic top view of the base element 2, wherein the light guide structure 3 is partly coated with the UV-curable composition 4. One recognizes that the circumferential borders of the light guide structure 3 are not coated in order to be able to couple-in UV light into the light guide structure 3.

If the light guiding material has to be UV-cured, too, this UV curing step is conducted preferably before coating of the UV-curable composition 4.

In the last step, the composition 4 is cured by coupling-in UV light into the light guide structure 3, transmitting and distributing said UV light through the light guide structure 3, and coupling-out said UV light into the composition 4. Additionally the surface of the UV-curable composition 4, which is opposite to the base material 2, is irradiated with UV light as well. The UV light path and the UV irradiation are symbolized by arrows in Fig. 1 and Fig. 4, wherein Fig. 4 shows a schematic sectional view of the coated base element 2 during this step of the process. The composition 4 is thus irradiated from the inside (bottom side) and from the outside (top side) at the same time and thus thoroughly cured to form a layer 5 with excellent adherence on the base element 2 of the household appliance component 1.

The idea of the invention therefore comprises the deposition of light guiding paths in a first step and to coat these light paths with the UV-curable composition 4. This allows to cure the composition 4 from the top but also from the bottom using UV light. Therefore the resulting layer 5 may have a very large thickness up to 100 μm or more without worsening the adhesion of the layer 5 on the base element 2.

One advantage of this process is the possibility of printing thick layers by inkjet printing or other coating techniques and curing the UV-curable composition 4 in one step instead of printing several thin layers. By reducing the number of different layers, the process time is reduced dramatically, thus increasing the efficiency of the process while lowering process costs.

In order to generate the light guide structure 3, a hybrid (organic-inorganic) polymer can be used which is mainly composed from GLYMO with 2 % of an acid photoinitiator (PAG) and optionally between 0.05 and 0.1 % of BYK-333, i. e. a silicone-containing surface additive for surface tension reduction. Depending on the specific needs, different additives could be added to modify certain properties. This material is formulated in such a way that its rheological properties allow the deposition by inkjet printing and other coating technologies. Further, the light guiding material exhibits certain advantages due to its hybrid properties. The presence of the epoxy groups in the GLYMO guarantees fast

curing properties, while the silane groups provide excellent adhesion in particular on glass substrates. Further, this hybrid polymer has a high thermal and chemical stability.

In order to increase the refractive index of this material (base ink), additional compounds can be added to the formulation such as SU8. The addition of this compound in weight fractions of between 1 % to 25 % to the base ink helps increasing the refractive index without adversely affecting the mechanical properties of the coating composition 4. Besides SU8, also other materials such as diphenyl dimethoxysilane (DPDMS) could also be used to increase the refractive index while maintaining the mechanical properties of the coating composition 4.

It will be understood by those skilled in the art that while the present invention has been disclosed above with reference to preferred embodiments, various modifications, changes and additions can be made to the foregoing invention, without departing from the spirit and scope thereof. The parameter values used in the claims and the description for defining process and measurement conditions for the characterization of specific properties of the invention are also encompassed within the scope of deviations, for example due to measurement errors, system errors, weighing errors, DIN tolerances and the like.

LIST OF REFERENCES

- 1 household appliance component
- 2 base element
- 3 light guide structure
- 4 UV-curable composition
- 5 layer

CLAIMS

1. A process for manufacturing a household appliance component (1), comprising the steps of:
 - providing a base element (2);
 - generating a light guide structure (3) on the base element (2);
 - coating at least a part of the light guide structure (3) with an UV-curable composition (4); and
 - at least partially curing the composition (4) by coupling-in UV light into the light guide structure (3), transmitting said UV light through the light guide structure (3) to the composition, and coupling-out said UV light into the composition (4).
2. The process according to claim 1, wherein the light guide structure (3) and/or the UV-curable composition (4) are deposited by at least one coating method on the base element (2), in particular by at least one of spin coating, spray coating, dip coating, serigraphy, and inkjet printing.
3. The process according to claim 1 or 2, wherein the light guide structure (3) is generated in the form of a mesh on the base element (2).
4. The process according to any one of claims 1 to 3, wherein UV light is coupled into at least two or more locations of the light guide structure (3), in particular into two or more locations spaced around a circumference of the light guide structure (3).
5. The process according to any one of claims 1 to 4, wherein a surface of the UV-curable composition (4), which is opposite to the base material (2), is irradiated with UV light.
6. The process according to any one of claims 1 to 5, wherein the light guide structure (3) has a higher refractive index than the base element (2) and/or wherein the light guide structure (3) is at least partly arranged on a cladding layer and/or at least partly arranged between two cladding layers and/or at least partly embedded in the cladding layer.

7. The process according to any one of claims 1 to 6, wherein at least one hybrid polymer is used to generate the light guide structure (3).
8. The process according to claim 7, wherein the hybrid polymer comprises by weight:
 - 1-99 % 3-glycidyloxypropyltrimethoxysilane
 - 0-5 % photoacid generator, in particular a triarylsulphonium salt
 - 0-2 % surfactant, in particular BYK-333
 - 0-70 % refractive index increasing compound, in particular SU8 and/or diphenyl dimethoxysilane
 - 0-10 % additive.
9. The process according to any one of claims 1 to 9, wherein the UV-curable composition (4) is coated with a layer thickness of at least 20 μm , in particular of at least 30 μm .
10. A household appliance component (1), comprising a base element (2), which at least in parts comprises at least one layer (5) made from a UV-curable composition (4),
characterized in that
a light guide structure (3), which is configured to couple-in UV light into the light guide structure (3), transmit said UV light through the light guide structure (3) to the layer (5), and couple-out said UV light to the layer (5), is arranged between the base element (2) and the layer (5).
11. The household appliance component (1) according to claim 10, wherein a thickness of the layer (5) is between 20 μm and 150 μm .
12. The household appliance component (1) according to claim 10 or 11, wherein the base element (2) at least in parts consists of glass and/or plastic and/or stainless steel and/or aluminum.

13. The household appliance component (1) according to any one of claims 10 to 12, which is manufactured by a process according to any one of claims 1 to 9.
14. A household appliance comprising at least one household appliance component (1), which is manufactured by a process according to any one of claims 1 to 9 and/or configured according to any one of claims 10 to 13.
15. The household appliance according to claim 14, which is configured as a cooker, a cooking field, an oven, a microwave oven, a dishwasher, a dryer, a washing machine, a freezer, and/or a steam oven.

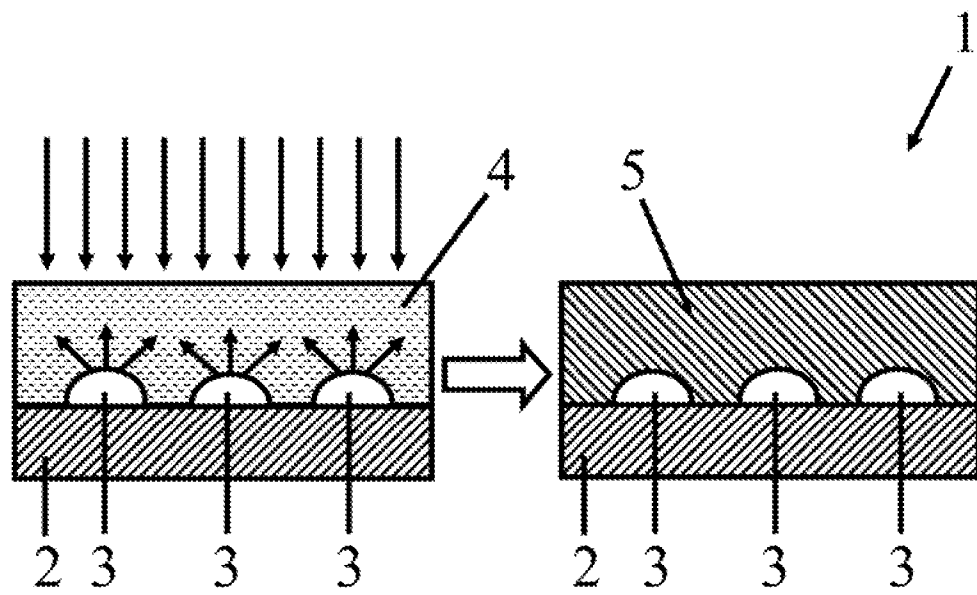


Fig. 1

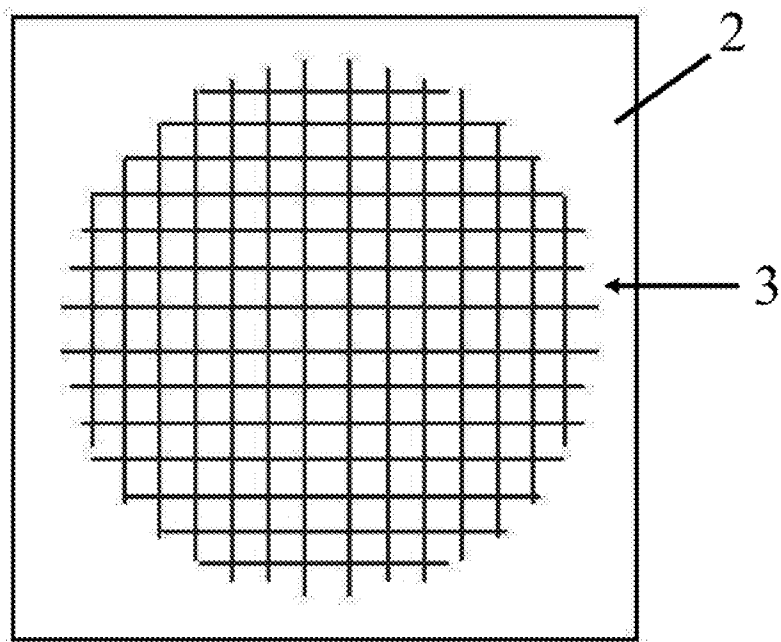


Fig. 2

201503485

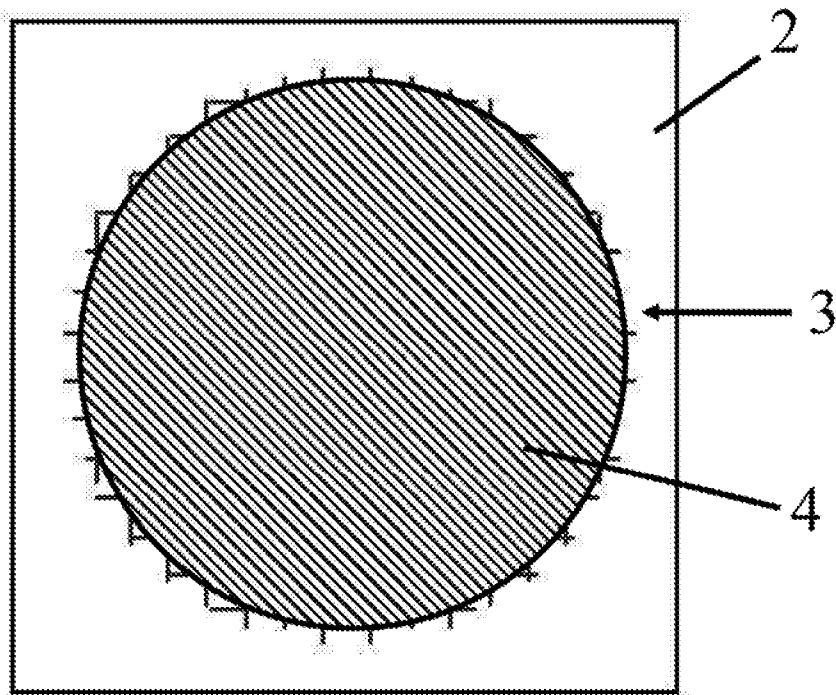


Fig. 3

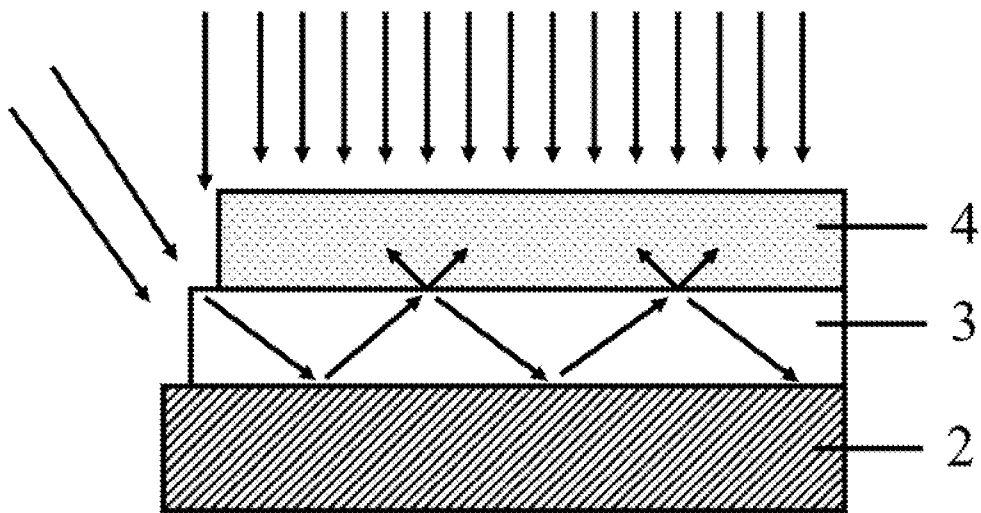


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/056785

A. CLASSIFICATION OF SUBJECT MATTER
INV. B32B37/14 B32B37/30
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)
B32B B29D C03C F24C

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/128041 A1 (RPO PTY LTD [AU]; CHARTERS ROBERT BRUCE [AU]; KUKULJ DAX [AU]; MAXWELL) 15 November 2007 (2007-11-15) claims; figures; examples -----	10-13
A		1-9
A	US 2013/093176 A1 (LOK PHEI [AU] ET AL) 18 April 2013 (2013-04-18) claims; examples -----	1-9
A	US 2015/151528 A1 (SHIMIZU KEISUKE [JP] ET AL) 4 June 2015 (2015-06-04) claims; examples -----	1-9
X	US 2015/144613 A1 (GUILLEMOT FRANCOIS [FR] ET AL) 28 May 2015 (2015-05-28) paragraph [0036] - paragraph [0036]; claims; figures; examples -----	14,15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

11 April 2017

Date of mailing of the international search report

20/04/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Devriese, Karel

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/056785

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9(completely); 10-13(partially)

Subject (1): a component comprising a base element, a light guide structure and a layer made from a UV-curable composition characterized in that the light guide structure is arranged between the base element and the layer and that the light guide structure is configured to couple-in UV light, transmit UV light and couple-out UV light ; characterised in that it is manufactured comprising the step of partially curing the UV curable composition of the layer by coupling out UV light from the light guide structure (claims; 1-9,10-13).

2. claims: 14, 15(completely); 10-13(partially)

Subject (2): a component comprising a base element, a light guide structure and a layer made from a UV-curable composition characterized in that the light guide structure is arranged between the base element and the layer and that the light guide structure is configured to couple-in UV light, transmit UV light and couple-out UV light ; characterised that it is used in a household appliance e.g. configured as a cooker, a cooking field, an oven, a microwave oven, a dishwasher, a dryer, a washing machine, a freezer, and/or a steam oven (claims; 10-13,14-15).

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/056785

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007128041 A1	15-11-2007	TW 200809287 A US 2007258691 A1 WO 2007128041 A1	16-02-2008 08-11-2007 15-11-2007
US 2013093176 A1	18-04-2013	AU 2011232304 A1 CN 102822703 A DE 112011101024 T5 FR 2961319 A1 GB 2493856 A US 2013093176 A1 WO 2011116419 A1	11-10-2012 12-12-2012 17-01-2013 16-12-2011 20-02-2013 18-04-2013 29-09-2011
US 2015151528 A1	04-06-2015	CN 104395083 A JP W02014007003 A1 KR 20150035693 A US 2015151528 A1 WO 2014007003 A1	04-03-2015 02-06-2016 07-04-2015 04-06-2015 09-01-2014
US 2015144613 A1	28-05-2015	CN 104379529 A DE 202013012143 U1 EP 2864266 A1 FR 2992313 A1 JP 2015521579 A KR 20150032836 A US 2015144613 A1 WO 2013190230 A1	25-02-2015 06-05-2015 29-04-2015 27-12-2013 30-07-2015 30-03-2015 28-05-2015 27-12-2013