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(54) A process to obtain chromium-plated effect coatings and a composition to carry out such process

(57) A process and a composition to obtain chromium-plated effect coatings on manufactured articles, comprising the steps of: (A) preparing the manufactured article; (B) applying a primer; (C) drying said primer; (D) applying an activator; (E) washing the manufactured article; (F) simultaneously applying a water-based mixture comprising 30% to 40% by weight of NaOH, 30% to 40% by weight of $AgNO_3$ and 10% to 12.5% by weight of an ammoniacal solution, and a water-based solution of carbohydrates; (G) washing the manufactured article; (H) drying the manufactured article; (I) applying a layer of transparent protection; (L) drying the manufactured article.

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Description

[0001] The present invention concerns a process to obtain chromium-plated effect coatings and a composition to carry out such process.

[0002] More precisely, the present invention concerns a process and a composition to obtain chromium-plated effect coatings by utilising a water-based painting system.

[0003] Galvanic chromium-plating processes are typically employed to obtain chromium-plated coatings, processes that are however deemed to be highly pollutant and dangerous for human health; as a matter of fact it is known that, during such processes, exhalations of acids and potentially cancerous chemical products occur, coming from the chromium-plating baths.

[0004] To the purpose of reducing the environmental impact, instead of the galvanic chromium-plating process, superficial refinish processes can be employed by means of chromium-plated painting, particularly by means of spray painting.

[0005] A spray painting process suitable for obtaining a metallised finish is disclosed in EP 0 346 954.

[0006] The aforementioned European Patent refers to a process for the metallising painting of manufactured articles made of materials of various kind (such as wood, plastic, foam rubber, polystyrene, etc.) of complicated three-dimensional shapes also having big size, manufactured articles such as, i.e., not to be generally dealt with by employing the conventional techniques; the same aforementioned European Patent further refers to an apparatus for carrying out the metallising process in both an easy and optimum way.

[0007] Even the technique according to the cited known prior art, which is based on the formation of a metal silver film on the surface of the manufactured article, obtained by reduction of silver nitrate ($AgNO_3$) in ammoniacal complex via a reducing sugar aqueous solution, has nevertheless the inconvenience of not producing a coating sufficiently resistant to the superficial grooves as well as to the flaking-off, i.e. of not preventing the deterioration of the homogeneity and stability characteristics in time and to the usage and, more in general, of the aesthetic appearance of the manufactured article.

[0008] A first purpose of the present invention is to provide a process to obtain chromium-plated effect coatings, said process allowing to overcome the limitations of the processes known so far, i.e. to eliminate the anti-aesthetic grooves that are created on the treated surfaces as well as the flaking-off of the surfaces themselves.

[0009] Another purpose of the invention is to provide a composition to carry out such process.

[0010] A further purpose of the invention is to provide a process and a composition that allow to obtain high homogeneity and uniformity of the final coating.

[0011] A further purpose of the invention is to provide a process and a composition that allow to reduce the costs arising from the use of silver and that further allow a flexible employ for very different kinds of manufactured articles in terms of materials and size.

[0012] The above and other purposes are achieved with the process and the composition as claimed in the attached claims.

[0013] Advantageously, thanks to the provision of at least a layer of primer, a chromium-plated effect coating is obtained, with adhesion characteristics higher than that achievable with the conventional processes of the known prior art.

[0014] Advantageously, thanks to the provision of at least a layer of protection, transparent or coloured, a chromium-plated effect coating is obtained, with characteristics of resistance to grooves higher than that achievable with the conventional processes of the known prior art.

[0015] Advantageously, furthermore, the process and the composition according to the invention allow to obtain high homogeneity and uniformity of the final coating.

[0016] Advantageously, furthermore, the process and the composition according to the invention allow to reduce the costs arising from the use of silver and further allow a flexible employ for very different kinds of manufactured articles in terms of materials, shapes and size.

[0017] The manufactured articles that can be advantageously subjected to the process to obtain chromium-plated effect coatings according to the invention, are generally manufactured articles made of metal, plastic, wood, gypsum, glass, ceramic, cement, foam rubber, polystyrene, polyurethane, fibreglass, all materials that do not have bright surfaces of metallic appearance.

[0018] The first step of the process to obtain chromium-plated effect coatings according to the invention provides for an accurate cleaning operation to eliminate dirt (dust, fatty residuals, etc.) left on the surface of the manufactured article due to the manufacturing process and the following storage; if necessary, a smoothing is performed, to make the surface smooth and without superficial defects.

[0019] In case the material is very porous and absorbent (for example, polystyrene, foam rubber or wood), the surface of the manufactured article is treated with at least a layer of base coat of a commercially available type suitable for the material of whom the manufactured article is made, and preferably of the type requiring the use of a catalyst.

[0020] On the surface of the so-treated manufactured article, it is then carried out the application of at least a layer of primer comprising 25% to 30% by weight of heavy aromatic solvent naphtha (petroleum), 10% to 12.49% by weight of xylene, 1% to 3% by weight of 1,2,4-trimethylbenzene, 1% to 3% by weight of solvent naphtha (coal) and 0.1 % to 0.25% by weight of hexafluorosilicate.

[0021] A catalyst is preferably added to the primer, said catalyst comprising 50% to 60% by weight of n-butyl acetate, 40% to 50% by weight of isocyanates and

0.1 % to 0.25% by weight of hexamethylene-1,6-diisocyanate.

[0022] The catalyst is generally added to the primer in a percentage preferably of about 20% by weight.

[0023] Moreover, the primer is preferably further added with a diluant comprising 50% to 60% by weight of n-butyl acetate and 50% to 60% by weight of xylene.

[0024] The diluant is generally added to the primer in a percentage 10% to 20% by weight.

[0025] The term "application" means, within the present disclosure, the operation of uniformly distributing a liquid product on the surface of the manufactured article.

[0026] This operation can be performed in many ways, even if it is preferably performed by spraying, for the better homogeneity achieved in the product distribution.

[0027] In the case of application of the layer(s) of primer, a particular care will be taken in uniformly executing such application, by spraying with a conventional spray gun.

[0028] The so-treated manufactured article is then located inside a furnace, for the drying step that takes place at a temperature in the range 50 ÷ 55 °C.

[0029] The manufactured article is kept in the furnace for a time period preferably of at least one hour, i.e. up to complete drying of the layer(s) of applied primer.

[0030] The following step of the process according to the invention provides for the application on the surface of the so-treated manufactured article of at least a layer of activator comprising an acid solution of tin inorganic salts and a salt, preferably stannous chloride 90 to 100% by weight.

[0031] The salt is added to the acid solution in a percentage preferably of about 0.3% by volume.

[0032] After having mixed its components, the activator is left to react for a time period preferably of at least some hours (2-4 hours depending on the room temperature) before the application.

[0033] In case of the application of the layer(s) of activator, a particular care will be taken in uniformly executing such application, by employing the apparatus disclosed in the already cited European Patent EP 0 346 954.

[0034] A first washing of the manufactured article follows, preferably with bi-distilled water, by immersing or preferably by atomising through a nozzles system to perform said washing uniformly; the washing of the surface treated with the activator is carried out to prevent the deposition of impurities onto the finish layer during its formation.

[0035] The following step is the process central step: during this phase, as a matter of fact, the coating conferring to the surface the desired chromium-plated effect is produced.

[0036] The metal silver reflecting film conferring to the manufactured article the chromium-plated effect is obtained by reduction of the silver ion (Ag^+) through the reaction known in Analytical Chemistry as "Tollens test".

[0037] In order to carry out the above-mentioned reaction, for the purposes of the present invention, on the surface of the manufactured article is applied at least a layer of chromium-plated solution by means of simultaneous application of a first component consisting of a water-based mixture comprising 30% to 40% by weight of NaOH, 30% to 40% by weight of $AgNO_3$ and 10% to 12.5% by weight of an ammoniacal solution, and of a second component consisting of a water-based solution of carbohydrates.

[0038] A particular care will be taken in executing the simultaneous application of the water-based mixture and of the water-based solution of carbohydrates as well as in uniformly executing the application, preferably in a bottom-up direction, by employing the proper apparatus disclosed in the already cited European Patent EP 0 346 954.

[0039] A second washing of the manufactured article follows, preferably with bi-distilled water, by immersing or preferably by atomising through a nozzles system to uniformly perform the second washing; a drying follows, preferably performed through an air blower apparatus, preferably in a top-down direction.

[0040] The following step consists in the application of at least a layer of transparent protection comprising 20% to 25% by weight of xylene, 10% to 12.49% by weight of 4-methyl-pentan-2-one(isobutyl methyl ketone), 7% to 10% by weight of n-butyl acetate and 5% to 7% by weight of cyclohexanone.

[0041] A catalyst is preferably added to the transparent protection, said catalyst comprising 50% to 60% by weight of isocyanates, 20% to 25% by weight of 1-methyl-2-methoxyethyl acetate, 15% to 20% by weight of n-butyl acetate, 5% to 7% by weight of light aromatic solvent naphtha (petroleum), 0.1% to 0.25% by weight of hexamethylene-1,6-diisocyanate and 0.1% to 0.25% by weight of 3-isocyanatemethyl-3,5,5-trimethylcyclohexyl isocyanate.

[0042] The catalyst is generally added to said transparent protection in a percentage of about 20% by weight. The protection can also comprise coloured pigments to give a desired tint to the manufactured article.

[0043] A particular care will be taken in uniformly executing the application, by spraying with a conventional spray gun.

[0044] The final step of the process according to the invention provides for a drying, preferably performed through an air blower apparatus.

[0045] The final drying step is carried out for a time period preferably of at least one hour, at a temperature of preferably 50°C.

[0046] Alternatively, the final drying step is carried out for a time period preferably of at least 12 hours, at a temperature preferably equal to the room temperature of about 20°C.

[0047] Advantageously, the process and the composition according to the invention give the manufactured

articled subjected to a chromium-plated effect coating excellent aesthetic characteristics as well as high performances of resistance to usage.

[0048] The invention could be further advantageously applied to any material forming any manufactured article.

[0049] With reference to the process above described, a carrying out example is hereinafter expounded.

Example

[0050] A manufactured article made of ABS (acrylonitrile, butadiene and styrene) was coated with a chromium-plated layer by using the following method.

[0051] A solution was produced containing primer, 20% by weight of catalyst and 10% by weight of diluant. The primer was consisting of 25% by weight of heavy aromatic solvent naphtha (petroleum), 12.49% by weight of xylene, 2% by weight of 1,2,4-trimethylbenzene, 2% by weight of solvent naphtha (coal) and 0.25% by weight of hexafluorosilicate; the catalyst was comprising 50% by weight of n-butyl acetate, 50% by weight of isocyanates and 0.25% by weight of hexamethylene-1,6-diisocyanate; the diluant was comprising 50% by weight of n-butyl acetate and 50% by weight of xylene.

[0052] The solution was uniformly applied on the manufactured article by spraying, this way realising a layer of primer. The so-treated manufactured article was then located inside a furnace, for the drying step that took place at a temperature in the range 50 ÷ 55 °C for about one hour.

[0053] On the dried layer of primer was applied a layer of activator comprising an acid solution of tin inorganic salts 0.3% by volume and stannous chloride 95% by weight.

[0054] After having mixed its components, the activator was left to react for some hours and then applied by means of spray apparatus.

[0055] The manufactured article was uniformly washed with atomised bi-distilled water.

[0056] Subsequently, on the manufactured article were simultaneously applied, by bottom-up spraying, a water-based mixture comprising 40% by weight of NaOH, 40% by weight of $AgNO_3$ and 12.5% by weight of an ammoniacal solution, and a water-based solution of carbohydrates.

[0057] The manufactured article was uniformly washed with bi-distilled water being atomised in a top-down direction.

[0058] The following step was providing for the spray application of at least a uniform layer of transparent protection comprising 25% by weight of xylene, 12.49% by weight of 4-methyl-pentan-2-one(isobutyl methyl ketone), 9% by weight of n-butyl acetate and 6% by weight of cyclohexanone.

[0059] The transparent protection was added with 20% by weight of catalyst comprising 60% by weight of isocyanates, 25% by weight of 1-methyl-2-methoxyethyl acetate, 20% by weight of n-butyl acetate, 7% by weight of light aromatic solvent naphtha (petroleum), 0.25% by weight of hexamethylene-1,6-diisocyanate and 0.25% by weight of 3-isocyanatemethyl-3,5,5-trimethylcyclohexyl isocyanate.

[0060] According to the invention the final drying was carried out by using hot air at about 50°C for about one hour.

Claims

1. A process to obtain chromium-plated effect coatings on manufactured articles, comprising the steps of:

   (A) subjecting to a preparation cycle the manufactured article to be coated;
   (B) uniformly applying on the surface of the manufactured article at least a layer of primer comprising 25% to 30% by weight of heavy aromatic solvent naphtha (petroleum), 10% to 12.49% by weight of xylene, 1% to 3% by weight of 1,2,4-trimethylbenzene, 1% to 3% by weight of solvent naphtha (coal) and 0.1% to 0.25% by weight of hexafluorosilicate;
   (C) drying inside a furnace said at least a layer of primer;
   (D) uniformly applying on the surface of the so-treated manufactured article at least a layer of activator comprising an acid solution of tin inorganic salts and a salt, preferably stannous chloride 90 to 100% by weight, said salt being added to said acid solution in a percentage preferably of 0.3% by volume;
   (E) uniformly washing the surface of the so-treated manufactured article;
   (F) uniformly applying, preferably in a bottom-up direction, on the surface of the so-treated manufactured article at least a layer of chromium-plated solution comprising a first and a second components, said first component being a water-based mixture comprising 30% to 40% by weight of NaOH, 30% to 40% by weight of $AgNO_3$ and 10% to 12.5% by weight of an ammoniacal solution, and said second component being a water-based solution of carbohydrates, said at least a layer of chromium-plated solution being obtained by simultaneous application of said first and second components;
   (G) uniformly washing the surface of the so-treated manufactured article;
   (H) drying the surface of the manufactured article;
   (I) uniformly applying by spraying on the surface of the so-treated manufactured article at least a layer of transparent protection compris-

ing 20% to 25% by weight of xylene, 10% to 12.49% by weight of 4-methyl-pentan-2-one (isobutyl methyl ketone), 7% to 10% by weight of n-butyl acetate and 5% to 7% by weight of cyclohexanone;
(L) drying the manufactured article.

2. A process according to claim 1, wherein said preparation cycle of the manufactured article comprises at least a step among cleaning, defatting, levelling, in order to eliminate any mark of dirt and superficial defects.

3. A process according to claim 1, wherein said primer is applied by spraying.

4. A process according to claim 1, wherein said washing steps are carried out with bi-distilled water, by immersing or by atomising through a nozzles system.

5. A process according to claim 1, wherein said drying steps are carried out with blown air, preferably in a top-down direction.

6. A process according to claim 1, wherein to said primer a catalyst is added comprising 50% to 60% by weight of n-butyl acetate, 40% to 50% by weight of isocyanates and 0.1 % to 0.25% by weight of hexamethylene-1,6-diisocyanate, said catalyst being added to said primer in a percentage of about 20% by weight.

7. A process according to claim 6, wherein said primer further comprises a diluant comprising 50% to 60% by weight of n-butyl acetate and 50% to 60% by weight of xylene, said diluant being added to said primer in a percentage 10% to 20% by weight.

8. A process according to claim 1, wherein said drying step is carried out in a time period preferably of at least one hour.

9. A process according to claim 1 or 8, wherein said drying step is carried out at a temperature in the range 50 ÷ 55 °C.

10. A process according to claim 1, wherein said activator, after having mixed its components, is left to react for a time period preferably of at least twenty-four hours before the application.

11. A process according to claim 1, wherein said transparent protection further comprises a catalyst comprising 50% to 60% by weight of isocyanates, 20% to 25% by weight of 1-methyl-2-methoxyethyl acetate, 15% to 20% by weight of n-butyl acetate, 5% to 7% by weight of light aromatic solvent naphtha (petroleum), 0.1% to 0.25% by weight of hexamethylene-1,6-diisocyanate and 0.1% to 0.25% by weight of 3-isocyanatemethyl-3,5,5-trimethylcyclohexyl isocyanate, said catalyst being added to said transparent protection in a percentage of about 20% by weight.

12. A process according to claim 11, wherein said protection further comprises coloured pigments to give the desired final tint to the manufactured article.

13. A process according to claim 1, wherein final drying step is carried out in a time period preferably of at least one hour.

14. A process according to claim 13, wherein final drying step is carried out at a temperature of preferably 50°C.

15. A process according to claim 1, wherein final drying step is carried out in a time period preferably of at least 12 hours.

16. A process according to claim 15, wherein final drying step is carried out at a temperature preferably equal to the room temperature of about 20°C.

17. A process according to claim 1, wherein said application step of the primer is preceded by an application step of at least a layer of base coat suitable to make the surface to be coated uniform.

18. A process according to claim 18, wherein said coat is of the type requiring the use of a catalyst.

19. A composition to carry out a process to obtain chromium-plated effect coatings according to any of the preceding claims, comprising at least:

(i) a primer comprising 25% to 30% by weight of heavy aromatic solvent naphtha (petroleum), 10% to 12.49% by weight of xylene, 1% to 3% by weight of 1,2,4-trimethylbenzene, 1% to 3% by weight of solvent naphtha (coal) and 0.1% to 0.25% by weight of hexafluorosilicate;
(ii) an activator comprising an acid solution of tin inorganic salts and a salt, preferably stannous chloride 90 to 100% by weight, said salt being added to said acid solution in a percentage preferably of 0.3% by volume;
(iii) a chromium-plated solution comprising a first and a second components, said first component being a water-based mixture comprising 30% to 40% by weight of NaOH, 30% to 40% by weight of $AgNO_3$ and 10% to 12.5% by weight of an ammoniacal solution, and said second component being a water-based solution of carbohydrates, said at least a layer of

chromium-plated solution being obtained by simultaneous application of said first and second components;
(iv) a transparent protection comprising 20% to 25% by weight of xylene, 10% to 12.49% by weight of 4-methyl-pentan-2-one(isobutyl methyl ketone), 7% to 10% by weight of n-butyl acetate and 5% to 7% by weight of cyclohexanone.

20. A composition according to claim 19, wherein said primer further comprises a catalyst comprising 50% to 60% by weight of n-butyl acetate, 40% to 50% by weight of isocyanates and 0.1% to 0.25% by weight of hexamethylene-1,6-diisocyanate, said catalyst being added to said primer in a percentage of about 20% by weight.

21. A composition according to claim 19 or 20, wherein said primer further comprises a diluant comprising 50% to 60% by weight of n-butyl acetate and 50% to 60% by weight of xylene, said diluant being added to said primer in a percentage 10% to 20% by weight.

22. A composition according to claim 19, wherein said transparent protection further comprises a catalyst comprising 50% to 60% by weight of isocyanates, 20% to 25% by weight of 1-methyl-2-methoxyethyl acetate, 15% to 20% by weight of n-butyl acetate, 5% to 7% by weight of light aromatic solvent naphtha (petroleum), 0.1% to 0.25% by weight of hexamethylene-1,6-diisocyanate and 0.1% to 0.25% by weight of 3-isocyanatemethyl-3,5,5-trimethylcyclohexyl isocyanate, said catalyst being added to said transparent protection in a percentage of about 20% by weight.

23. A composition according to claim 22, further comprising coloured pigments to give the desired final tint to the manufactured article.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 02 9926

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

C23C
B05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	27 February 2004	Polesak, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 02 9926

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