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(54) **Process for coating threaded metallic pieces**

Verfahren zur Beschichtung metallischer Teile mit Gewinde

Procédé pour le revêtement de pièces métalliques filetées

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EP 2 468 929 B1

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Description

[0001] The present invention relates to a process for coating threaded metallic pieces, in particular screws for use for example in the automobile field.

[0002] EP-A-1 992 477 describes a process for coating metal sheets for application in televisions or household electrical appliances in general.

[0003] US-A-2005/019 600 describes a process for coating steel plates for use in building.

[0004] EP-A-1 679 130 describes a process for coating steel sheets for domestic use with a plurality of layers.

[0005] US-A-2003/072 949 describes a process for coating metal sheets for motor vehicle bodywork parts, which requires the electro-deposition of a resin.

[0006] EP-A-1 607 426 describes a process for production by extrusion of a rolled sheet, in particular for cans.

[0007] US-A-4 898 775 describes a process for coating metal sheets with a paint containing atoms of fluorine applied by means of plasma.

[0008] US-A-5 178 903 describes a process for coating penetration fasteners for timber (therefore necessarily not threaded), which provides for the application of a paint that is mandatorily based on aliphatic polyurethane.

[0009] US-A-4 165 242 describes a process for coating metallic pieces of various kinds, which provides mandatorily for electrophoretic deposition of an organic paint using special insulated cathodes.

[0010] It is an object of the present invention to provide a process which makes it possible to obtain a coating having a glossy appearance, durable over time, as well as a high resistance to repeated tightening cycles, to heat loosening, to environmental corrosion and to attack by corrosive fluids.

[0011] According to the invention, this object is achieved by a process for coating a threaded metallic piece, comprising in the order at least the steps of:

- using said piece as cathode of an electrolytic cell, wherein a bath containing at least Zn and Ni ions is present, whereby the electro-deposition of a first layer containing Zn and Ni is brought about on the surface of the piece,
- subjecting the piece to a passivation treatment, and
- applying on the piece a further layer of a polyester-based paint.

[0012] Advantageously, the electrolytic cell is provided with membranes screening the electrodes.

[0013] Preferably, before the electro-deposition the piece is subjected to degreasing and/or pickling treatments.

[0014] In preferred embodiments of the process of the invention, the layer of paint is applied in two coats and the application of each coat of paint requires first the immersion of the piece in a bath of paint, then centrifuging and finally baking.

[0015] It should be noted that the process of the invention is intended exclusively for coating threaded metallic pieces, such as screws, nuts, bolts etc., and it is therefore intrinsically different from and not comparable with processes for coating metal sheets or similar two-dimensional articles. It also necessarily required that the metallic piece to be coated should be used as cathode for the deposition of the first layer containing Zn and Ni, and that the paint layer - i.e. the outer layer of the coating, exposed to the external environment - should be polyester-based. None of the prior documents mentioned above, alone or in combination with the others, describes an individual embodiment incorporating all these characteristics, nor respectively prompts the expert in the field to actually implement it.

[0016] Further advantages and characteristics of the present invention will become evident from the following representative example, provided with non-limiting effect.

EXAMPLE

[0017] Wheel screws M14x48.5 are first subjected to degreasing in a bath of caustic soda of a concentration of 50 cm³/l at a temperature of 60°C for 18 minutes, to subsequent anodic cleaning with a bath of caustic soda of a concentration of 100 cm³/l at a temperature of 40°C and an electrical voltage of 10 V for 6 minutes, and finally to pickling in a bath of hydrochloric acid 16°Bé without additives at a temperature of 20°C for 12 minutes.

[0018] The screws thus treated are used as cathode of an electrolytic cell provided with membranes screening the electrodes.

[0019] In the cell there is a bath containing Ni and Zn ions, supplied by the company Coventya under the commercial system name "Performa 285". This bath furthermore contains sodium hydroxide and cleaning and brightening additives.

[0020] Keeping the screws in the electrolytic cell at a temperature of 25°C, under an electrical voltage of 8 V and for a time of 96 minutes, achieves the electro-deposition of a layer of Zn-Ni on their surfaces.

[0021] The screws thus coated are then passivated in a bath of salts of Cr(III) and Co (supplied by the company Coventya under the commercial name FINIDIP) having a concentration of 80-100 cm³/l for 6 minutes.

[0022] It should be noted that between all the various steps listed above, washing in water and neutralisations are performed.

[0023] The screws coated with the first layer and passivated are dried at a temperature of 60°C in a centrifuge at 300 rpm for 7 minutes, and then left to settle for at least 36 hours without coming into contact with polluting agents (oils, dust etc.) of any kind.

[0024] After settling, the screws are immersed in a bath of paint having a viscosity of 38-42" for 25 seconds. During immersion the screws are rotated at 10 rpm.

[0025] The polyester-based paint containing a black

pigment is supplied by the company Doerken under the commercial name Deltaprotekt VL451GZ.

[0026] The screws are then centrifuged for 13 seconds at 260 rpm to standardise the thickness of the coat of paint which has been deposited on them.

[0027] The screws are then moved into a pre-oven kept at a temperature of 100°C for a time of 20 minutes and into an oven kept at a temperature of 185°C for a time of 50 minutes, so as to bake the first coat of paint.

[0028] On coming out of the oven, the screws are cooled by exposure to a blast of air at ambient temperature.

[0029] The steps listed above - from immersion in a bath of paint onwards - are then repeated a second time to apply a second coat of paint.

[0030] In this way screws are obtained coated with a first layer of Zn-Ni and a second layer of paint. The characteristics of the layers and of the finished screws are as follows.

First layer of Zn-Ni

[0031]

Thickness: 8-12 μm ,
Ni content: 12-15%,
Wettability: 38 mN/m,
Tightenability: 6g,
Appearance: matt black, slightly iridescent without the presence of brightening agent.

Second layer of paint (applied in two coats)

[0032]

Paint quantity: 0.070-0.080 g/screw,
Surface area of one screw: 34 cm^2 ,
Density of dried paint: 1.7 g/cm^3 ,
Thickness: 11-14 μm .

Finished screw

[0033] Total thickness of the two layers of coating: 19-26 μm (in such a way that the screw complies with a thread check using a threaded ring having a tolerance of 6h, with a maximum torque of 2.8 Nm);

[0034] Appearance: gloss black without accumulations of paint (in particular in the recess in the head and in the threads) and without bare patches.

[0035] Axial pull generated by tightening to 140 Nm:

- 30-60 kN over 5 consecutive tightenings;
- 20-60 kN over a further 5 consecutive tightenings.

[0036] Resistance to saline mist after 10 tightenings to 140 Nm and heating to 120°C for 24 hours:

- 120 hours without white salts, 720 hours without red

salts.

[0037] Resistance to acids:

- 5 - after 10 consecutive tightenings to 140 Nm, 5 immersions for 2 minutes each in hydrochloric acid solution 2%, brushing and remaining in a humidostatic chamber for 2 hours, no red salts appeared on the head of the screw;
- 10 - after 10 consecutive tightenings to 140 Nm, 5 immersions for 2 minutes each in phosphoric acid solution 5%, brushing and remaining in a humidostatic chamber for 2 hours, no red salts appeared on the head of the screw.

[0038] Resistance to heat loosening:

- 20 - after tightening to 140 Nm, heating to 160°C for 2 hours, 3 series of loosening / tightening as far as the initial angular position, minimum torques of 50 Nm were obtained on an aluminium washer and 70 Nm on a steel washer.

[0039] In sum, threaded pieces, in particular wheel screws coated by the process of the invention, surprisingly and completely unexpectedly have a combination of properties which render them particularly useful for the intended use, that is to say:

- 30 - homogeneous gloss black appearance, aesthetically very pleasing,
- high resistance to atmospheric agents and to salt scattered on the road, even after repeated cycles of tightening/loosening due to tyre changes,
- 35 - high resistance to aggressive chemical substances, such as the detergents used for cleaning wheel rims and other substances used in the automobile field such as fuels, lubricants and brake fluids with which such screws can accidentally come into contact,
- 40 - highly stable coefficient of friction, which is particularly important in view of the fresh tightening which must be carried out at each tyre change,
- resistance to heat loosening, up to temperatures of the order of 160°C, which can be reached because of overheating due to repeated braking.

[0040] Naturally, without prejudice to the principle of the invention, the details of execution and the embodiments can vary widely with respect to what has been described purely by way of example, without thereby departing from the scope of the invention as defined in the attached claims.

Claims

1. Process for coating a threaded metallic piece, comprising in the order at least the steps of:

- using said piece as cathode of an electrolytic cell, wherein a bath containing at least Zn and Ni ions is present, whereby the electro-deposition of a first layer containing Zn and Ni is brought about on the surface of the piece,
 - subjecting the piece to a treatment of passivation, and
 - applying on the piece a further layer of a polyester-based paint.
2. Process according to claim 1, wherein said electrolytic cell is provided with membranes screening the electrodes.
 3. Process according to any one of previous claims, wherein the piece is subjected to treatments of degreasing and/or pickling prior to the electro-deposition.
 4. Process according to any one of previous claims, wherein said layer of paint is applied in two coats.
 5. Process according to claim 4, wherein the application of each coat of paint provides for first of all immersing the piece in a bath of paint, centrifuging and then baking.
 6. Process according to any one of previous claims, wherein said piece is a wheel screw.
 7. Process according to any one of previous claims, wherein said first layer has a thickness comprised between 8 and 12 μm , and said paint layer has a thickness comprised between 11 and 14 μm .
 8. Process according to any one of previous claims, wherein said paint contains a black pigment.

Patentansprüche

1. Verfahren zum Beschichten eines mit Gewinde versehenen Metallteils, wobei das Verfahren der Reihe nach mindestens die folgenden Schritte aufweist:
 - Verwenden des Teils als Kathode einer elektrolytischen Zelle, in welcher ein Bad, das mindestens Zn- und Ni-Ionen enthält, vorhanden ist, um dadurch die galvanische Abscheidung einer ersten Schicht, die Zn und Ni enthält, auf der Oberfläche des Teils zu erzielen,
 - Unterziehen des Teils einer Passivierungsbehandlung und
 - Aufbringen einer zusätzlichen Schicht eines Lacks auf Polyesterbasis auf das Teil.
2. Verfahren nach Anspruch 1, wobei die elektrolytische Zelle mit Membranen versehen ist, die die Elek-

troden abschirmen.

3. Verfahren nach einem der vorstehenden Ansprüche, wobei vor der galvanischen Abscheidung das Teil Behandlungen zum Entfetten und/oder Abbeizen unterzogen wird.
4. Verfahren nach einem der vorstehenden Ansprüche, wobei die Lackschicht in zwei Beschichtungen aufgebracht wird.
5. Verfahren nach Anspruch 4, wobei das Aufbringen jeder Lackbeschichtung zunächst Eintauchen des Teils in ein Lackbad, Zentrifugieren und dann Einbrennen aufweist.
6. Verfahren nach einem der vorstehenden Ansprüche, wobei das Teil eine Radschraube ist.
7. Verfahren nach einem der vorstehenden Ansprüche, wobei die erste Schicht eine Dicke zwischen 8 und 12 μm hat und die Lackschicht eine Dicke zwischen 11 und 14 μm hat.
8. Verfahren nach einem der vorstehenden Ansprüche, wobei der Lack ein schwarzes Pigment aufweist.

Revendications

1. Procédé pour le revêtement d'une pièce métallique filetée, comportant, dans l'ordre ci-dessous, au moins les étapes consistant à :
 - utiliser ladite pièce comme cathode d'une cellule électrolytique dans laquelle est présent un bain contenant au moins des ions Zn et Ni, le dépôt électrolytique d'un premier revêtement contenant Zn et Ni étant provoqué à la surface de la pièce ;
 - la soumission de la pièce à un traitement de passivation ; et
 - l'application, sur la pièce, d'un autre revêtement de peinture à base de polyester.
2. Procédé selon la revendication 1, dans lequel ladite cellule électrolytique est pourvue de membranes protégeant les électrodes.
3. Procédé selon l'une quelconque des revendications précédentes, dans lequel la pièce subit des traitements de dégraissage et/ou de décapage avant le dépôt électrolytique.
4. Procédé selon l'une quelconque des revendications précédentes, dans lequel ledit revêtement de peinture est appliqué en deux couches.

5. Procédé selon la revendication 4, dans lequel l'application de chaque couche de peinture comprend tout d'abord une immersion de la pièce dans un bain de peinture, puis une centrifugation et une cuisson. 5
6. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite pièce est une vis de roue.
7. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite première couche a une épaisseur de 8 à 12 μm et ledit revêtement de peinture a une épaisseur de 11 à 14 μm . 10
8. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite peinture contient un pigment noir. 15

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REFERENCES CITED IN THE DESCRIPTION

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