(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 475 452 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.11.2004 Bulletin 2004/46

(51) Int Cl.[7]: **C23C 4/00**, C23C 14/00

(21) Application number: **04010656.9**

(22) Date of filing: **05.05.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK

(30) Priority: **08.05.2003 SE 0301362**

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(54) Method for treating an aluminium or aluminium alloy surface

(57) The invention concerns a method for treating a surface of aluminum or aluminum alloy. The method is characterized by a new combination of pretreatment and surface coating. The surface (1) intended for treatment is pretreated by means of anodization and coated with epoxy phenol adhesive primer. The pretreated surface is then sprayed with epoxy material in powder form with particle size in the 15 - 25 μm range. The powder-coated surface is heated to the curing temperature of the epoxy material, 115 - 130°C, whereupon the epoxy material is caused to cure.

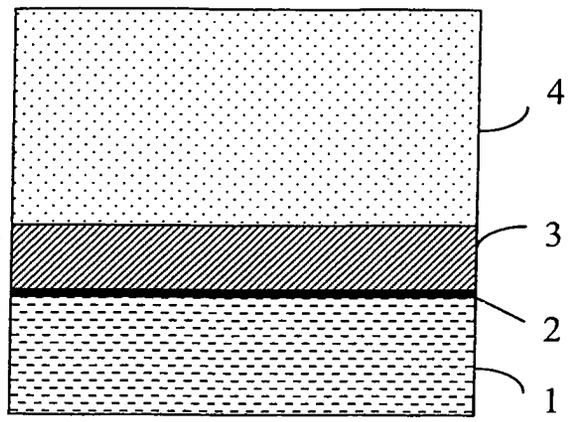

Fig 1

EP 1 475 452 A2

Description

TECHNICAL AREA

[0001] This invention concerns a method for treating a surface of aluminum or aluminum alloy.

STATE OF THE ART

[0002] Surface treatment by means of powder coating is well known commercially for surface-treating various materials. However, in the airplane industry it has proven difficult to use surface treatment by means of powder coating of aluminum and aluminum alloys, which are primarily intended for structural applications. The reason for this is that most of the powders that are currently available require overly high temperatures during curing, which reduces the strength of the aluminum alloy.

[0003] Another reason why powder coating has been very little used in the airplane industry is that it is difficult to achieve the sufficiently thin coatings, under 50 μm, that are needed in the airplane industry. A new epoxy powder that cures at low temperatures has been developed for airplane applications by Interpon©. However, the problem of finding a pretreatment for aluminum which, together with the powder coating, meets all the requirements for airplane applications, still exists.

DESCRIPTION OF THE INVENTION

[0004] The surface coating of aluminum or aluminum alloys according to the invention is based on a pretreatment in combination with spraying with epoxy powder.

[0005] The requirements that can be imposed in connection with the surface treatment of structural components for airplane applications are met by means of the proposed method. The proposed method for surface coating offers many advantages in terms of both improved environmental friendliness in connection the treatment process and improved surface coating.

[0006] The use of organic solvents can be drastically reduced by using the new surface treatment combination. Calculations indicate a reduction of upwards of 60%. Furthermore, the use of chromates can be reduced, since anodizing with phosphoric acid can replace the earlier anodization with chromic acid. The binding primer contains roughly 5% chromates, as compared to the proportion of 20% found in the conventional primer. The total coating thickness can be further reduced by approximately one-third in relation to the thickness associated with the use of a conventional lacquer system, which yields a weight saving that is valuable in the airplane industry.

[0007] The proposed method for surface coating is also superior to the conventional method in terms of resistance to chemical reactions, impacts and adhesive properties. A substantial prolongation of service life can be expected as a result.

[0008] Conducted testing has shown that the door-to-door time for production is reduced by at least 50% in comparison with the conventional method.

BRIEF FIGURE DESCRIPTION

[0009]

Figure 1 shows a conventional surface coating according to the state of the art.
Figure 2 shows a surface coating realized by means of the combination of primer treatment and powder application according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0010] Figure 1 shows an aluminum surface 1 with a surface coating according to conventional methods. The aluminum surface is anodized using chromic acid in a first layer 2, which has a layer thickness on the order of 2 - 5 μm. A primer layer 3 according to the conventional surface-treatment method has a thickness on the order of 15 - 25 μm. The final surface coating is realized in two to four steps, with a resulting layer 4 on the order of 40 - 60 μm. One problem associated with the conventional methods is that it is necessary to use a large amount of environmentally hazardous solvents. The layers 2 - 4 must also be made relatively thick, which results in an undesirably high weight in an aviation context.

[0011] Figure 2 shows a surface coated according to the new method for surface coating. An aluminum surface 1 has been anodized with phosphoric acid and provided with a coating 6 of primer with a thickness of 5 - 10 μm. The technique involved in this pretreatment is a well known process that is currently used in connection with surface treatment prior to metal-gluing and spray-painting.

[0012] Before coating with primer and coating with the epoxy material in powder form, the items intended to be coated must be anodized. This is preferably done using a phosphoric acid anodizing process. The lead wire dimensions and number of contact points are adjusted based on the material and item. The various items are mounted on holders so that the treatment bath and rinse water come into contact with all surfaces. The items are anodized in 100 - 120 g/l phosphoric acid at a temperature of 22 - 28°C and at voltage of 15 ± 1V. The voltage is kept constant for a specified period of time, which can be on the order of 20 - 25 minutes. The items are then removed from the anodizing bath and rinsed. The items are then dried thoroughly, after which an inspection is performed on the anodized layer 5 formed.

[0013] The adhesive primer must be applied within roughly three days after the completion of , anodization and subsequent drying. The adhesive primer is used to improve adhesion and protect against corrosion. Preferred primer consists mainly of epoxy and phenol, optionally with strontium chromate added as a corrosion

inhibitor. Priming is preferably performed immediately after surface treatment, or alternatively within no more than two hours - in connection with storage in a clean room within 72 hours. The primer is applied by spraying. If the resulting primer layer 6 after spraying is thinner than desired, an additional layer may be applied before curing to increase the thickness.

[0014] After application, the primer must dry at room temperature. The primer layer is cured thereafter at temperatures in the 110 - 135°C range for 60 - 120 minutes, or at 80 - 90°C for 24 hours. The interval between primer application and curing should not exceed 120 hours.

[0015] The thickness of the primer layer 6 must preferably be on the order of 5 - 10 μm. Thicker primer layers are of course also possible; however, the use of thicker layers diminishes the major advantages associated with the invention, since the new surface-treatment method makes it possible to reduce solvent emissions by reducing the thickness of the primer layer.

[0016] Top coating of the phosphoric acid-anodized and adhesive primer-treated items is performed using a one-component epoxy powder top coat. This powder lacquer must not be used on items that are exposed to directly sunlight, but rather is intended primarily for use internally in the airplane. A powder lacquer from Interpon© is used in one preferred embodiment of the invention. This powder is characterized in that it consists of epoxy particles of very low particle size, 15 - 25 μm. The powder is used as delivered and undergoes no additional processing before being applied to the item in question.

[0017] The powder is applied by electrostatic means. The item is grounded and the particles in the powder are electrified, whereupon the powder is sprayed at the item. After application, the lacquered surface is allowed to cure for about 30 minutes at temperatures in the 115-135°C range. The powder coating is realized in a layer 7 with a thickness of 40 - 50 μm. The thickness of the layer 7 can naturally be varied within the framework of the concept of the invention; however, because weight is an important factor in the airplane industry, the layer 7 should be kept as thin as is deemed possible.

Claims

1. A method for treating a surface (1) of aluminum or aluminum alloy, **characterized by** the following steps in combination: the surface is pretreated by means of anodization and coated with a primer of epoxy phenol, the pretreated surface is sprayed with epoxy material in powder form that has a particle size in the range of 15 - 25 μm, the surface is heated to the curing temperature of the epoxy material, 115 - 130°C, whereupon the epoxy material melts and is caused to cure.

2. A method according to claim 1, wherein the powder coating is realized in a layer (7) with the thickness 30 - 50 μm.

3. A method according to any of the preceding claims, wherein the primer layer (6) is given a thickness in the 5 - 10 μm range.

4. A method according to claim 3, wherein the anodization is performed using phosphoric acid.

5. A method according to any of the preceding claims, wherein the coating is performed using an epoxy powder from Interpon©.

6. A method according to any of the preceding claims wherein the surface treatment is performed on formed and worked sheet metal items such as ribs and wing structures.

7. A method according to any of claims 1 - 5, wherein the surface treatment is performed on machined items such as forgings and castings.

State of the art

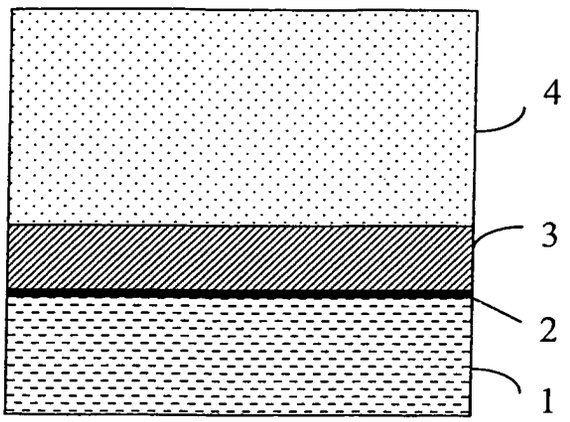

Fig 1

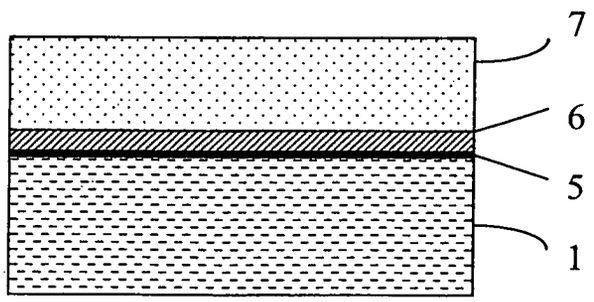

Fig 2