

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 975 436 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

06.02.2002 Bulletin 2002/06

(21) Application number: **98917884.3**

(22) Date of filing: **14.04.1998**

(51) Int Cl.7: **B05D 1/02**, B05D 1/08

(86) International application number:
PCT/SE98/00670

(87) International publication number:
WO 98/46369 (22.10.1998 Gazette 1998/42)

(54) **METHOD FOR COATING**

BESCHICHTUNGSVERFAHREN

PROCEDE DE REVETEMENT

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB IT LI NL

(30) Priority: **14.04.1997 SE 9701363**

(43) Date of publication of application:
02.02.2000 Bulletin 2000/05

(73) Proprietor: **Applied Composites AB ACAB**
580 13 Linköping (SE)

(72) Inventor: **OBRELIUS, Per**
S-589 27 Linköping (SE)

(74) Representative: **Willquist, Bo**
Willquist & Partners Patentbyrå AB,
Platensgatan 9c
582 20 Linköping (SE)

(56) References cited:
SE-C- 502 759 **US-A- 4 239 827**
US-A- 4 246 294

EP 0 975 436 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a method of coating at least one section of the surface of a plastic or composite part by means of thermal spraying with an additive material, as indicated in the pre-characterising clause of claim 1.

[0002] Coating metal parts by thermal spraying with an additive material in the form, for example, of a second metallic material or ceramics is already known. In this way modified surface characteristics can be achieved which allows the parts to be used in spheres of application that would otherwise be out of the question. The surface of the metal part to be coated in this way is usually pre-treated by blasting. The additive material is then sprayed on to the surface of the blasted part. The additive material, after spraying, is supposed to shrink as it is cooled by the surface and adheres in the small irregularities that are created by the blasting.

[0003] The method described above does not function satisfactorily, however, when seeking to coat the above-mentioned plastic or composite parts with additive material by means of thermal spraying. The thermal conductivity of plastic or composite materials is generally too low for the coating material to shrink tight with sufficient speed. Plastic or composite materials furthermore tend to shrink somewhat on heating, which is also not conducive to good adhesion. If a composite surface is pre-treated by blasting, this can also lead to damage to the outermost layer of fibres in the composite, which adversely affects the surface strength.

[0004] EP 514640 relates to a method for coating a fibre reinforced plastic body. In order to apply by means of a thermo-spray method an adhering, resistant metallic or ceramic coating on bodies consisting of a plastic matrix and reinforcing fibres a material is added in form of small particles to the surface of the fibre reinforced plastic body directed to the thermal spray layer applied later, which material is capable of chemically set to the material serving as thermal coating material. The surface of the body to be coated is treated, before the thermal spraying, in such a way that bare clean surfaces are achieved, which improve the adhesive capacity of the layers.

[0005] In one embodiment of a method according to the present invention, a coating is produced on at least one section of the surface of a plastic or composite part, as indicated by claim 1, which exhibits the advantages described below compared to coatings that are produced by known methods.

[0006] The method according to the invention and the products produced thereby have several advantages:

[0007] By means of the method according to the invention, plastic or composite parts can be produced with coatings of various additive materials, such as ceramics, metal oxides, metals, metal alloys or plastics, the adhesion of which to the part is very good.

[0008] Using the method according to the invention to

treat a surface of a composite part avoids damage to the outermost layer of fibres and impairment of the surface strength resulting from this.

[0009] The method according to the invention permits many new spheres of application for plastic and composite parts; for example composite parts can hereby be coated with titanium, for which there may be a number of medical applications.

[0010] The invention will be explained in more detail below with the aid of an example of an embodiment of the method according to the invention and the product produced thereby and with reference to the drawings attached in which:

15 Fig. 1. shows the pre-treatment of a section of the surface of a part that is to be coated.

Fig 2. shows a layer of a thermosetting adhesive being applied to a section of the surface of the part that was pre-treated according to fig. 1.

20 Fig 3. shows the thermosetting adhesive that was applied in fig. 2 being heated to a temperature approaching the gel point of the adhesive.

25 Fig 4. shows the surface provided with the layer of thermosetting adhesive being coated by thermal spraying of an additive material.

30 Fig 5. shows the part being placed in an oven, after coating according to fig. 4 and before heating to the setting temperature of the adhesive layer.

35 Fig 6. shows the finished part after coating with an additive material and setting of the adhesive layer have been carried out.

[0011] Figure 1 illustrates the pre-treatment of a section of the surface 2 of a part 1 made from a composite material. The part surface 2 in question is first degreased, for example with acetone. The surface 2 is then lightly sanded with a fine sandpaper or abrasive nylon 3 in order to remove irregularities and to roughen the surface slightly. Finally the surface is degreased and dried again.

[0012] Figure 2 shows how a layer 4 of a thermosetting adhesive, here in the form of an adhesive film, is applied to the surface 2 pre-treated according to figure 1. In applying the adhesive film it is important to ensure that no contaminating substance is allowed to come into contact with the pre-treated surface 2 or the adhesive. Instead of applying the adhesive in the form of a film, as shown in figure 2, it may be applied, for example, by spraying or by applying it with a brush. Several different types of adhesive are conceivable, for example epoxy adhesive, acrylic adhesive, urethane adhesive or phenolic plastic-based adhesive.

[0013] Figure 3 shows how the layer of thermosetting adhesive 4 is heated by means of a hot air gun 5 to a temperature approaching the gel point of the adhesive. This gives the adhesive layer 4 a very good adhesive capacity. The adhesive layer 4 can obviously be heated in other ways different from that illustrated in figure 3, for example in an oven or the like.

[0014] Figure 4 shows how the pre-treated surface 2 provided with the adhesive layer 4 is coated with a layer 6 of an additive material by thermal spraying, for example by flame spraying. This additive material may be any of the following, for example: a ceramic; metal oxide; metal; metal alloy or plastic. The temperature of the sprayed material can be adjusted by the choice of spraying method. Conceivable methods of spraying in addition to flame spraying include, for example, electric arc spraying, plasma spraying or detonation spraying. The application temperature may be varied from approximately 50°C to several hundred degrees Celsius by the use of different spraying methods and additive materials. The application temperature and method of application are adapted to the adhesive used, its gelling and setting temperature, or vice versa. The adhesive is selected having regard to the additive material and the application temperature in order to achieve the best possible strength and surface layer quality for the coating 6.

[0015] Figure 5 shows how the part 1, after coating has been carried out, is placed in an oven 7 or the like for heating up to the setting temperature of the adhesive layer 4, so that this is made to set, which means that an excellent adhesive bond is obtained between the surface coating 6 and the composite material. Due to the fact that the adhesive layer 4, before coating, is heated to a temperature approaching its gel point, as in figure 3, the time taken for this stage of the method is minimised since only a certain further heating is required.

[0016] Figure 6 shows the finished part 1 after it has been coated with a layer 6 of an additive material and the adhesive layer 4 has been set by the method according to the invention.

[0017] The method according to the invention has given the part 1 a good surface coating 6, which for certain applications can be further improved by sealing it with phenolic resin-based paint when it has cooled to room temperature. This can prevent the adhesive from absorbing moisture, for example, which may adversely affect the adhesive bond.

In addition the phenolic resin-based paint can give the surface a certain added protection, for example if the latter is to be exposed to high temperatures.

[0018] It will be obvious to a person skilled in the art that the method according to the invention is not confined to the embodiment described above, but rather can lend itself to modifications within the framework of the following claims. After a first coating layer has been applied and set by the method according to the invention, for example, further layers of different materials can be applied on top of this by means of thermal spraying,

without the need here to apply any adhesive film.

Claims

1. Method of coating at least one section of the surface (2) of a plastic or composite part by thermal spraying with a layer (6) of an additive material, wherein before coating with the additive material is carried out a layer (4) of a thermosetting adhesive is applied to the said section of the surface (2) of the part and **characterised in that** the part (1), after coating, is heated to the setting temperature of the adhesive layer (4), thereby causing it to set.
2. Method according to claim 1, **characterised in that** before coating is carried out the thermosetting adhesive layer (4) is heated to a temperature approaching its gel point,

Patentansprüche

1. Verfahren zum Beschichten von wenigstens eines Abschnittes der Oberfläche (2) eines Kunststoff- oder Verbundwerkstoffteiles durch thermisches Spritzen mit einer Schicht (6) aus einem Additivwerkstoff, wobei bevor das Beschichten mit dem Additivwerkstoff ausgeführt wird eine Schicht (4) aus einem thermisch bindenden/aushärtenden Leim auf den gesagten Abschnitt der Oberfläche (2) des Teils aufgebracht wird, und **dadurch gekennzeichnet, daß** das Teil (1) nach dem Beschichten auf die Abbinde temperatur der Leimschicht (4) aufgeheizt wird und dabei verursacht wird, daß diese abbindet.
2. Verfahren gemäß Anspruch 1, **dadurch gekennzeichnet, daß** bevor das Beschichten ausgeführt wird, die thermisch bindende/aushärtende Leimschicht (4) auf eine Temperatur aufgeheizt wird, die ihrem Gelierpunkt nahekommt.

Revendications

1. Procédé de revêtement d'au moins une partie de la surface (2) d'une pièce en matière plastique ou composite, par projection à chaud d'une couche (6) de matière additive, dans lequel, avant l'exécution du revêtement par la matière additive, une couche (4) d'adhésif thermodurcissable est appliquée sur ladite partie de la surface (2) de la pièce, et **caractérisé en ce que** la pièce (1) est, après le revêtement, chauffée jusqu'à la température de prise de la couche d'adhésif (4), permettant ainsi à celle-ci de durcir.

2. Procédé selon la revendication 1, **caractérisé en ce que**, avant l'exécution du revêtement, la couche d'adhésif thermodurcissable (4) est chauffée jusqu'à une température proche de son point de gélification.

5

10

15

20

25

30

35

40

45

50

55

Fig 1

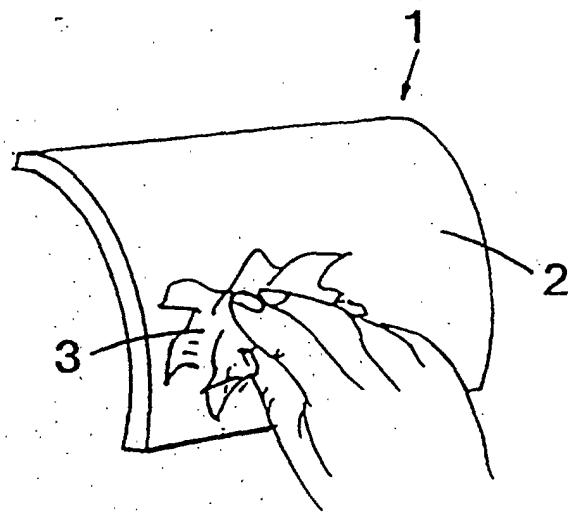


Fig 2

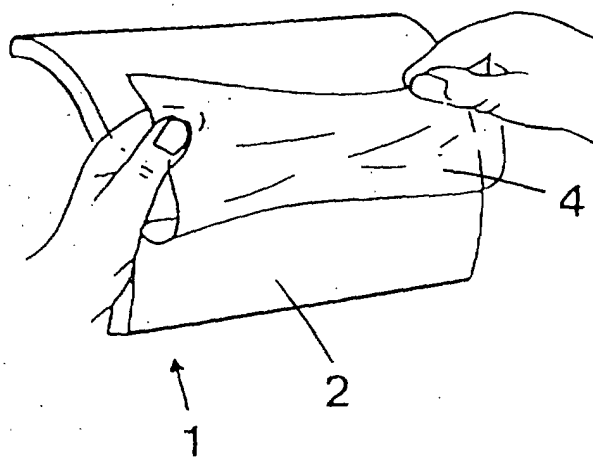


Fig 3

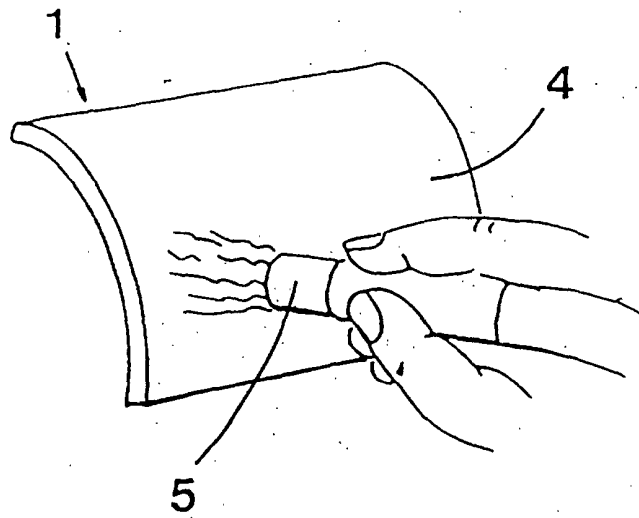


Fig 4

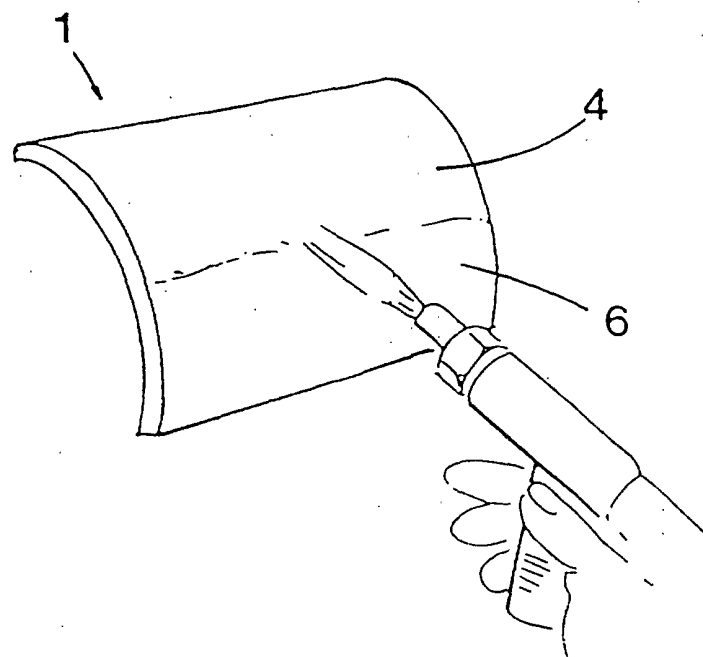


Fig 5

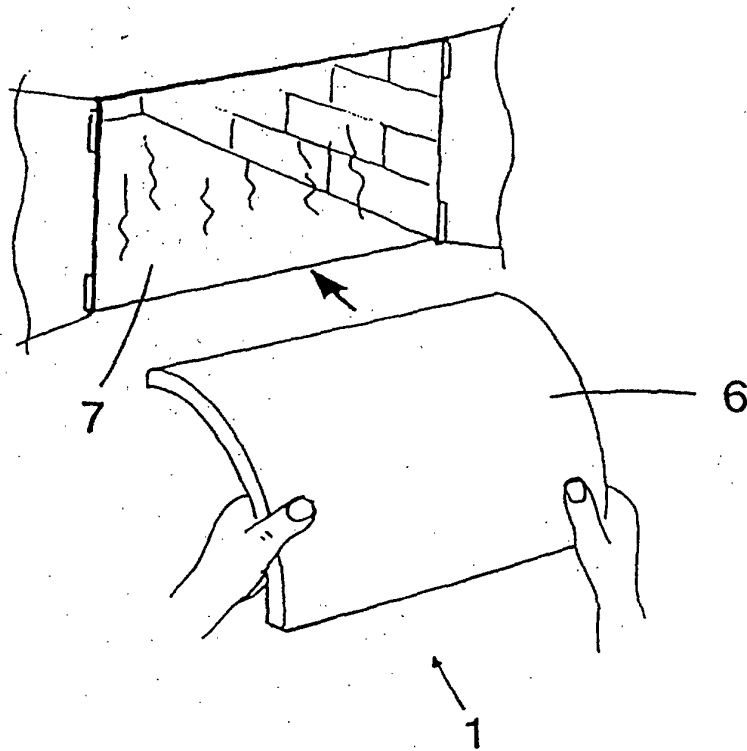


Fig 6

