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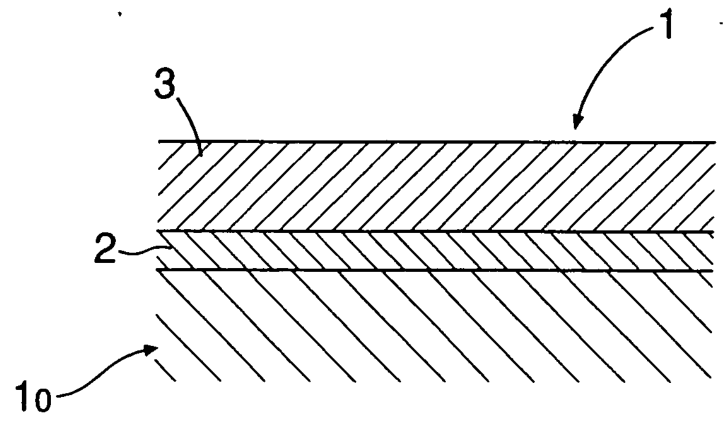
(54) CORROSION-RESISTANT Al-BASED STRUCTURAL MEMBER AND METHOD FOR MANUFACTURE THEREOF

(57) A corrosion-resistant Al-based structural member (1) is provided that has a base layer (2) adhered to the surface of an Al-based structural member (1_0), and a corrosion-inhibiting coating (3) adhered to the surface of the base layer (2). The base layer (2) is made of Zn, and the corrosion-inhibiting coating (3) is made of a trivalent Cr-containing chromate coating for Zn. It is thereby possible to provide a corrosion-resistant Al-based structural member equipped with a nonpolluting corrosion-inhibiting coating containing no hexavalent chromium.

FIG.2



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a corrosion-resistant Al-based structural member and a production process therefor. Here, the Al-based structural member includes both a structural member made of pure Al and a structural member made of an Al alloy.

BACKGROUND ART

[0002] Conventionally, as this type of Al-based structural member, an arrangement in which a corrosion-inhibiting coating made of a chromate coating is provided is known (e.g., Japanese Patent Publication No. 60-35432).

[0003] However, since the conventional chromate coating is formed using a treatment liquid containing CrO_3 as an essential component, the coating contains hexavalent Cr. As is well known, hexavalent Cr is an element that is harmful to the human body, and it is therefore desirable for the corrosion-inhibiting coating to contain no hexavalent Cr from the viewpoint of preventing pollution.

DISCLOSURE OF INVENTION

[0004] It is an object of the present invention to provide a corrosion-resistant Al-based structural member that includes a nonpolluting corrosion-inhibiting coating containing no hexavalent chromium.

[0005] In order to attain this object, in accordance with the present invention, there is provided a corrosion-resistant Al-based structural member that includes a base layer adhered to the surface of an Al-based structural member, and a corrosion-inhibiting coating adhered to the surface of the base layer, the base layer being made of Zn, and the corrosion-inhibiting coating being made of a trivalent Cr-containing chromate coating for Zn.

[0006] This corrosion-inhibiting coating has excellent corrosion resistance and is useful in terms of preventing pollution since it contains no hexavalent Cr, which is harmful to the human body. Furthermore, although the trivalent Cr-containing chromate coating for Zn cannot adhere directly to the surface of the Al-based structural member, the coating exhibits sufficient adhesion to the base layer made of Zn, that is, the surface of the Zn base layer. Moreover, it is easy to form a Zn base layer adhering to the surface of the Al-based structural member by employing a known zincate treatment, etc.

[0007] It is another object of the present invention to provide a production process that enables the corrosion-resistant Al-based structural member having this arrangement to be mass produced.

[0008] In order to attain this object, in accordance with the present invention, there is provided a process for producing a corrosion-resistant Al-based structural member, the process including a step of forming a base layer made of Zn, that is, a Zn base layer, on the surface of an Al-based structural member by a zincate treatment, and a step of forming a corrosion-inhibiting coating made of a trivalent Cr-containing chromate coating for Zn on the surface of the Zn base layer by a chromate treatment using a trivalent chromate agent.

[0009] In accordance with this production process, the corrosion-resistant Al-based structural member having the above-mentioned arrangement can be obtained easily and reliably. Furthermore, the zincate treatment and the chromate treatment are both carried out by employing a dip method, and the two treatments may be carried out as an in-line process, thereby improving the productivity.

[0010] A treatment time t_1 required for the zincate treatment is set at a value, for example $t_1 \geq 30$ s, that enables the amount of Zn deposited on the surface of the Al-based structural member to be increased to give a Zn base layer having a required thickness. On the other hand, a treatment time t_2 required for the chromate treatment is set at a value, for example $t_2 \leq 15$ s, that enables the trivalent Cr-containing chromate coating for Zn to be reliably formed on the surface of the Zn base layer while ensuring the thickness of the Zn base layer, despite the Zn base layer being dissolved by the chromate treatment. When the treatment time t_1 for the zincate treatment is less than 30 s, the thickness of the Zn base layer is insufficient for the chromate treatment, whereas when the treatment time t_2 for the chromate treatment is more than 15 s, dissolution of the Zn base layer proceeds, thus giving rise to a possibility that the surface of the Al-based structural member might be exposed.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

FIG. 1 is a front view of a carburetor main body made of a corrosion-resistant Al alloy, and FIG. 2 is an enlarged sectional view of an essential part of the carburetor main body made of the corrosion-resistant Al alloy.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] FIG. 1 shows a corrosion-resistant carburetor main body 1 made of an Al alloy, which corresponds to the corrosion-resistant Al-based structural member. As shown in FIG. 2, this corrosion-resistant carburetor main body 1 is obtained by providing an unprotected surface of a carburetor main body 1_0, obtained by die-casting using JIS ADC12, with a base layer 2, which is adhered thereto, and a corrosion-inhibiting coating 3, which is adhered to the surface of the base layer 2. The base layer 2 is made of Zn, whereas the corrosion-inhibiting coating 3 is made of a trivalent Cr-containing chromate coating for Zn.

[0013] This corrosion-inhibiting coating 3 has excellent corrosion resistance and is useful in terms of prevention of pollution since it does not contain hexavalent Cr, which is harmful to the human body. Furthermore, the trivalent Cr-containing chromate coating for Zn cannot directly adhere to the surface of the carburetor main body 1_0, which is made of an Al alloy, but exhibits sufficient adhesion to the surface of the base layer made of Zn, that is, the Zn base layer 2. Moreover, it is easy to form the Zn base layer 2 adhering to the surface of the carburetor main body 1_0 made of an Al alloy by employing a known zincate treatment, etc.

[0014] When producing the corrosion-resistant carburetor main body 1, the die-cast carburetor main body 1_0 is first subjected to a known pretreatment, that is, sequentially washing with hot water, degreasing, washing with water, activating, washing with water, and washing with hot water. Subsequently, a step of forming the Zn base layer 2 on the surface of the pretreated carburetor main body 1_0 by a zincate treatment, a water washing step, a step of forming the corrosion-inhibiting coating 3, which is made of a trivalent Cr-containing chromate coating for Zn, on the surface of the Zn base layer 2 by a chromate treatment employing a trivalent chromate agent, a water washing step, and a drying step are carried out in sequence.

[0015] In accordance with this production process, the corrosion-resistant carburetor main body 1 having the above-mentioned arrangement can be obtained easily and reliably. Furthermore, since the zincate treatment and the chromate treatment are both carried out by employing a dip method, the two treatments may be carried out as an in-line process, thus improving the productivity.

[0016] A treatment time t_1 required for the zincate treatment is set at a value, for example $t_1 \geq 30$ s, that enables the amount of Zn deposited on the surface of the carburetor main body 1_0 to be increased to give the Zn base layer 2 having a required thickness. On the other hand, a treatment time t_2 required for the chromate treatment is set at a value, for example $t_2 \leq 15$ s, that enables the trivalent Cr-containing chromate coating for Zn to be reliably formed on the surface of the Zn base layer 2 while ensuring the thickness of the Zn base layer 2, despite the Zn base layer 2 being dissolved by the chromate treatment.

[Embodiment]

[0017] As a main component of a zincate treatment liquid, a Zn substitution liquid (product name: K-102, manufactured by Japan Kanigen Co., Ltd.) was selected. This zinc substitution liquid contains 18.6 wt % of NaOH, 3.1 wt % of ZnO, 7.8 wt % of an organic acid, and a trace amount of an additive. The concentration of this liquid was adjusted to 220 mL/L to give a zincate treatment liquid.

[0018] As a main component of a chromate treatment liquid, a trivalent chromate agent (product name: Dipsol ZT-444A, liquid form, manufactured by Dipsol Chemicals Co., Ltd.) was selected. This trivalent chromate agent contains 14 to 16 wt % (Cr^{3+}: 4) of chromium nitrate [$Cr(NO_3)_3 \cdot 9H_2O$], 2 to 4 wt % of cobalt nitrate [$Co(NO_3)_2$], with the balance being normal materials, and they are existing chemical substances. The concentration of this liquid was adjusted to 60 mL/L to give a chromate treatment liquid.

[0019] A plurality of the Al alloy carburetor main bodies (JIS ADC12, die-cast) 1_0 as described above were prepared, and they were subjected to the pretreatment described above. Subsequently, various types of corrosion-resistant carburetor main bodies 1 were obtained by carrying out, in sequence, formation of the Zr base layer 2 using the zincate treatment liquid at 30°C for various treatment times t_1, washing with water, formation of the corrosion-inhibiting coating 3 using the chromate treatment liquid at 30°C for various treatment times t_2, washing with water, and drying.

[0020] These corrosion-resistant carburetor main bodies 1 were subjected to a brine spray test, and the percentage area A of white product (product due to corrosion of Al alloy) 48 hours after starting the test, that is, A = (area of white product / total surface area of carburetor main body) x 100 (%), was determined. Table 1 shows the treatment time t_1 of the zincate treatment, the treatment time t_2 of the chromate treatment, and the percentage area A of the white product related to Examples 1 to 6 of the corrosion-resistant carburetor main bodies 1.

[Table 1]

Corrosion-resistant carburetor main body	Treatment time of zincate treatment t_1 (s)	Treatment time of chromate treatment t_2 (s)	Percentage area of white product A (%)
Example 1	50	15	1
Example 2	30	15	3
Example 3	15	15	10
Example 4	15	30	30
Example 5	15	50	70

[0021] As is clear from Table 1, if the treatment time t_1 of the zincate treatment is set at $t_1 \geq 30$ s and the treatment time t_2 of the chromate treatment is set at $t_2 \leq 15$ s, as in Examples 1 and 2, an Al alloy carburetor main body 1 having excellent corrosion resistance can be obtained. In the case of Examples 3 to 5, since the treatment time t_1 of the zincate treatment was 15 s, the Zn base layer 2 was relatively thin, but since the treatment time t_2 of the chromate treatment was t_2 = 15 s < t_2 = 30 s < t_2 = 50 s, the amount of the surface of the carburetor main body 1_0 exposed increased in the order Example 3, Example 4, Example 5, and the corrosion resistance also deteriorated in this order.

[0022] The Al-based structural member is not limited to the Al alloy carburetor main body, and includes a throttle body, a solenoid valve main body, a compressor housing, etc. made of an Al alloy, and further includes a structural member made of pure Al.

Claims

1. A corrosion-resistant Al-based structural member comprising a base layer (2) adhered to the surface of an Al-based structural member (1_0), and a corrosion-inhibiting coating (3) adhered to the surface of the base layer (2), the base layer (2) comprising Zn, and the corrosion-inhibiting coating (3) comprising a trivalent Cr-containing chromate coating for Zn.

2. A process for producing a corrosion-resistant Al-based structural member, the process comprising a step of forming a base layer (2) comprising Zn on the surface of an Al-based structural member (1_0) by a zincate treatment, and a step of forming a corrosion-inhibiting coating (3) comprising a trivalent Cr-containing chromate coating for Zn on the surface of the base layer (2) by a chromate treatment using a trivalent chromate agent.

3. The process for producing a corrosion-resistant Al-based structural member according to Claim 2, wherein a treatment time t_1 required for the zincate treatment is set at a value that enables the amount of Zn deposited on the surface of the Al-based structural member (1_0) to be increased to give the base layer (2) comprising Zn having a required thickness, and a treatment time t_2 required for the chromate treatment is set at a value that enables the trivalent Cr-containing chromate coating for Zn to be reliably formed on the surface of the base layer (2) while ensuring the thickness of the base layer (2), despite the base layer (2) being dissolved by the chromate treatment.

4. The process for producing a corrosion-resistant Al-based structural member according to Claim 3, wherein the treatment time t_1 required for the zincate treatment is ≥ 30 s, and the treatment time t_2 required for the chromate treatment is ≤ 15 s.

FIG.1

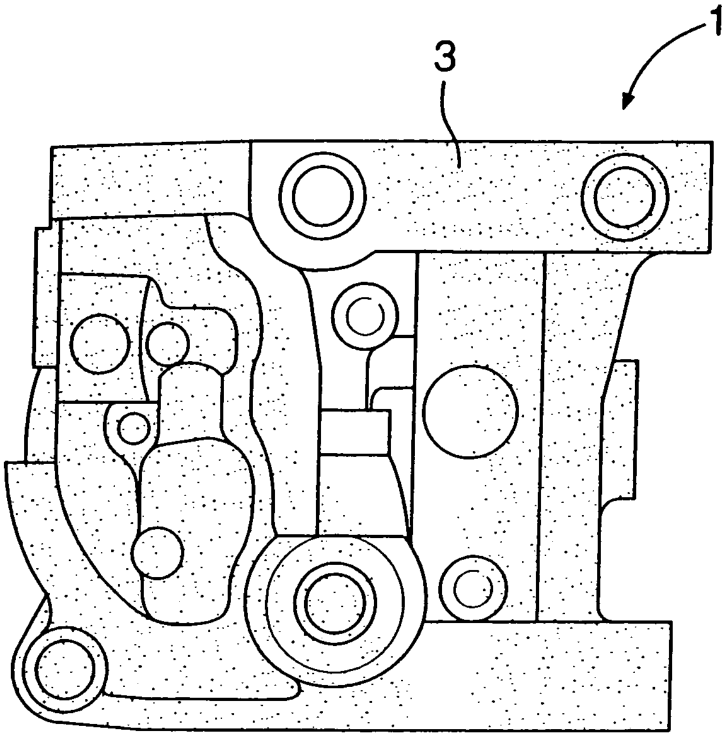
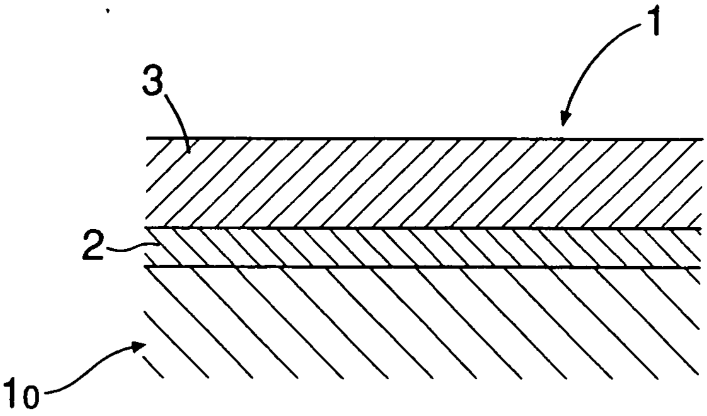


FIG.2



INTERNATIONAL SEARCH REPORT

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PCT/JP03/10225

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl^7 C23C28/00, 22/78

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)
Int.Cl^7 C23C28/00, 22/78

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Toroku Jitsuyo Shinan Koho	1994-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Jitsuyo Shinan Toroku Koho	1996-2003

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 54-10243 A (Dipsol Chemicals Co., Ltd.), 25 January, 1979 (25.01.79), (Family: none)	1-4
Y	JP 7-126859 A (Nihon Parkerizing Co., Ltd.), 16 May, 1995 (16.05.95), (Family: none)	1-4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
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