In-line surface treatment for obtaining aluminium extrusions coated with a corrosion-resistant layer and extrusions thus obtained

Process for manufacturing aluminium alloy extruded profile parts which are resistant to the corrosion resulting from their contact with the air and humidity, comprising the following steps:

a) providing a billet;

b) extruding the billet through a die to create at least one profile having the desired shape and length and optionally cooling or quenching the profile after the exit of the die;

c) optionally stretching the profile;

d) sawing the extruded profile to obtain profile parts at the desired length; characterised in that during step b) a corrosion-resistant layer is coated on the fresh metal surface exiting from the extrusion press by spraying a fluid solution near the exit of the die. The fluid solution is preferably a sol gel medium made from mixing a polysiloxane solution and an aqueous colloidal silica solution.

Profile parts coated with a corrosion resistant layer obtained by the said process.
The invention relates to extruded aluminium alloy profiles which are coated with a corrosion resistant layer. It relates more particularly to profiles coated by alternative coating processes which replace expensive batch processes such as anodizing or powder coating.

When they are not coated with a protective layer, extruded aluminium alloy profiles can develop cosmetic corrosion such as staining or discoloration, sometimes within a few days or weeks of natural exposure. As a result, they become unsightly and therefore unsuitable for the application for which they were intended.

To overcome this problem and other forms of corrosive attacks, it is known from patents or patent applications such as US4952452, CN2885613, CA2625779 to coat the profile with several types of layers, either organic paint, inorganic sol-gel coatings or by anodising to thicken the aluminium oxide.

However, these processes are costly and require, in addition to the final coating operation, extensive degreasing, cleaning and surface pre-treatments to ensure good performance.

For example, the anodising process is generally carried out on the profiles after their ageing treatment. This process is preceded by degreasing and etching steps and followed by a sealing step. In addition, as the protective anodised layer is deposited when the profile is set to an anodic potential in an electrolytic bath, many handlings are required to obtain a good electrical contact ensuring the formation of a regular and homogeneous anodisation layer on the entire profile. Such handlings are very difficult to automate because of the geometric variety of profiles to be treated. Moreover, the electrical contact areas are not covered and must be then removed, thereby increasing the profile scrap ratio. As a result, it is a long and expensive batch process.

In addition, after being coated, the work-piece must normally be heated either to cure the organic/inorganic coating or to hydrothermally seal an anodic oxide: this heat treatment adds further costs and can also have a negative impact on the mechanical properties of the substrate.

More generally speaking, the contact of aluminium profiles with the air and the humidity can not be prevented and the resulting corrosion makes the appearance of the surface non attractive. Commonly used surface treatment processes are batch processes, applied on cut profiles, which need different pre-treatments necessary to prepare the surface for the real surface treatment. As this surface treatment is made separately, after extrusion and, if any, heat treatment, several handling processes are necessary. In other words, as soon as any corrosion resistance is wished, long and expensive batch processes should be used, even if the wished corrosion resistance is undemanding or low demanding.

The applicant has investigated alternative surface treatment processes which improve the corrosion resistance of the profiles compared to non-treated products and which nevertheless are less expensive than known solutions such as anodising.

A first purpose of the present invention is providing a process for manufacturing aluminium alloy extruded profile parts which are resistant to corrosion, comprising the following steps:

a) providing a billet in the said aluminium alloy at a temperature suitable for the extrusion;

b) extruding the billet through a die to create at least one profile having the desired shape and length and optionally cooling or quenching the profile after the exit of the die;

c) optionally stretching the profile, to obtain a plastic deformation typically below about 1%;

d) sawing the extruded profile to obtain profile parts at the desired length;

characterised in that during step b) a corrosion-resistant layer is coated on the surface of the profile by depositing a fluid solution on the freshly formed metal surface exiting from the extrusion press, the resulting coating becoming then, by evaporation and/or curing and/or any other physical or chemical transformation, the said corrosion-resistant layer.

The process according to the invention basically remains a classical extrusion process, but with an additional coating step occurring simultaneously with the extrusion step. A device is preferably used for depositing the said fluid solution on the freshly formed surface of the profile. The latter is located near the exit of the extrusion press, preferably downstream of the quenching workstation, if any, and upstream of the saw, preferably upstream of the reception table, also called "run out table". Therefore this surface treatment process can be easily adapted to any common extrusion line. The process according to the invention necessitates low investment. It can be carried out through a shortened fabrication process chain, with a reduced number of process steps.

Once the end of the profile, which initially exits from the die, is out of the extrusion press, the latter is usually caught by a device called a puller, which drives the said profile during the entire extrusion step with a speed adapted to the speed of the profile so that the profile remains straight and slightly stretched up to the run out table. At the end of the extrusion step, the mandrel of the extrusion press is stopped; the container is removed from the die set so that the butt, i.e. the remaining portion of the billet, can be sheared. After the butt is sheared, the final end of the profile is released.
and the profile can then be driven again by the puller until it is fully located on the said run out table. Advantageously, the depositing device works in coordination with the puller in such a manner that there is no coating accumulation when the extrusion press is stopped for removing the container and shearing the butt.

According to the invention, no cleaning process or chemical pre-treatment is necessary since the metal exiting from the die is very freshly formed (only a very thin oxide layer will be found on the surface). Indeed, the surface of the profile at the exit of the die is clean and in a good condition for a coating application.

The deposit of a protective coating is advantageously achieved by spraying a fluid solution or medium with a viscosity low enough to be able to be sprayed by a nozzle without quick clogging thereof and a viscosity high enough to form a stable and continuous coating on the profile surface. This coating process step is quicker than any batch process of the prior art and makes it possible to obtain a coating thickness of between 0,1 μm and 20 μm, preferably between 0,1 μm and 3 μm. Depending on the fluid solution used in the process, the corrosion resistant layer may have a thickness between 0,1 μm and 0,4 μm or between 0,4 μm and 3 μm. However, according to the number and the location of the nozzles of the spraying device, the coating obtained is more or less regular and homogeneous. Therefore, the present coating process step is especially recommended for profiles, which should be corrosion resistant, but with undemanding requirements related this corrosion resistance. For example, the present coating process is recommended for profiles, which should be resistant to the cosmetic corrosion which results from their contact with the air and humidity.

Generally, aluminium alloy extrusions should be cooled or quenched at the exit of the extrusion press to a specific temperature range to ensure adequate mechanical properties after the ageing treatment. Particularly if the fluid solution contains flammable materials, such as a sol-gel precursor or a varnish, the temperature of the profile should be less than a critical value, typically the autoignition temperature of the flammable material and it is therefore recommended to deposit the fluid solution after the profile has been quenched to a temperature less than this critical value. For example, if the solid solution is a sol-gel type solution, the temperature targeted after quench is advantageously between 80 °C and 250 °C, preferably between 140 °C and 210 °C, more preferably between 150 °C and 200°C.

According to the invention, after the profile is optionally quenched and the fluid solution is deposited on the freshly extruded metal, the latter is still hot enough that the heat retained in the metal is used to start to cure the deposited coating. The curing of the coating is completed during the ageing of the profiles, so that a separate curing treatment of the coating is not necessary. Thus, since the deposit of the fluid solution is done at the same time as extrusion and since the coating is cured by the ageing treatment of the profiles, the manufacturing process according to the invention is largely time-saving compared to processes of prior art.

The coating obtained by using this process provides significant improvement in corrosion properties in comparison with uncoated profiles. It is significantly less expensive than conventional coating processes due to less handling and treatment process steps. In the following example, the fluid solution to be applied on the profile at its exit from the extrusion press is a sol-gel precursor. Any other fluid solution able to form a corrosion resistant coating could be used, for example an acrylic, polyester or epoxy-based lacquer or varnish, provided that this fluid solution can be applied with an appropriate device and that the part of the extrusion line located downstream of the extrusion press is not quickly clogged, for example by the fog resulting from spraying the said fluid solution near the fresh surface of the profile.

In a preferred embodiment of the invention, the corrosion resistant layer is a coating obtained by spraying a sol-gel precursor on the freshly formed metal surface of the profile.

By "sol-gel precursor" it is to be understood that a coating is produced by the sol-gel technology, which, from application of a liquid solution of organo-metallic precursor chemicals on a substratum (here the profile), forms after curing a hardened protective layer fixed on the said substratum. The protective layer is preferably a transparent curable sol-gel coating, through which the colour tone of the metallic substrate can be detected.

The protective layer applied on the fresh surface of the substrate is preferably a sol-gel coating, in particular, a sol-gel coating made of a polysiloxane and advantageously a sol-gel coating made of a polysiloxane prepared from an alcoholic silane solution, especially an alkoxysilane solution, and an aqueous colloidal silica solution. Polysiloxane is the term for polymers of crosslinked siloxanes. The polysiloxane is generated in particular by an acid catalyzed condensation reaction between hydrolyzed silanes, also known as silanols.

The condensation reaction between hydrolyzed silanes, especially alkoxysilanes, and colloidal silica results in the formation of an inorganic network of polysiloxanes. At the same time, organic groups may be built in the inorganic network with carbon bonds. The organic groups, for example alkyl groups, such as methyl, ethyl, propyl or butyl, do not participate directly to the polymerization or crosslinking of the siloxanes. They do not serve to form an organic polymer system but only to achieve the functionalization of the said siloxanes. According to the application to which the profiles are intended, functional properties, such as surface energy, hydrophobicity, oleophobicity and flexibility of the final cured coating, may be modified by an appropriate choice of organo-functional silanes.

In a preferred embodiment, a sol-gel precursor is prepared from two basic solutions A and B. Solution A is an alcoholic solution of one or more different alkoxysilanes, where the alkoxysilanes are present in a non-hydrolyzed form in an anhydrous medium. Preferably, an alcohol is used as a solvent, such as methyl, ethyl, propyl, or butyl alcohol or, preferably, isopropyl alcohol. The alkoxysilanes are described by the general formula $X_nSi(OR)_{4-n}$ in which "R" is a...
simple alkyl, preferably from the group comprising methyl, ethyl, propyl and butyl. "X" is also an alkyl, preferably from the group comprising methyl, ethyl, propyl and butyl. Appropriate alkoxysilanes are for example tetramethoxysilane (TMOS), preferably tetraethoxysilane (TEOS), and methyl trimethoxysilane (MTMOS).

In a particularly preferred embodiment, the solution A is prepared from a tetraethoxysilane (TEOS) and/or methyl trimethoxysilane (MTMOS) using a methyl, ethyl or propyl alcohol, and in particular an isopropyl alcohol, as a solvent. Solution A can contain for example 25 - 35 wt% (% by weight), preferably 30 wt%, TEOS and 15 - 25 wt%, preferably 20 wt%, MTMOS, both dissolved in 40 - 60 wt%, preferably 50 wt%, isopropyl alcohol.

Solution B contains colloidal silica dissolved in water. In a preferred embodiment, solution B is set with an acid, preferably with nitric acid (HNO₃), to a pH value between 2.0 and 4, preferably between 2.5 and 3.0 and more preferably close to 2.7. The silica used is stabilized in an acid medium, where the pH is advantageously between 2 and 4. The silica has advantageously alkali content as low as possible, preferably less than 0.04 wt % Na₂O.

Solution B contains for example 70-80 wt%, preferably 75 wt%, water as a solvent and 20 - 30 wt%, preferably 25 wt%, colloidal silica. The solution B is set with nitric acid (HNO₃) to a pH value between 2.0 and 3.5, preferably between 2.5 and 3.0, more preferably close to 2.7.

The mixing of the two basic solutions A and B in the presence of nitric acid results into a hydrolysis reaction between the water contained in solution B and the alkoxysilanes contained in solution A. The hydrolysis reaction is:

$$\text{Si(OR)}_n + n\text{H}_2\text{O} \rightarrow \text{Si(OH)}_n + n\text{R(OH)}$$

Simultaneously, a condensation reaction occurs, where a siloxane bond (Si-O-Si) is formed from two Si-OH groups, accompanied by the formation of water. A network of polysiloxanes affiliated with alkyl groups is formed by progressive polymerization. The resulting mixed solution is in a gel-like state. The two solutions A and B are preferably mixed in a weight ratio of 7:3.

Preferably, the sol-gel precursor is applied in a gel form having appropriate fluidity to be sprayed on the profile fresh surface, and then dried and/or cured. The drying process consists in expelling water and alcohols remaining in the sol-gel coating, whereby the sol-gel coating hardens and a corrosion- and weather-resistant protective layer is formed on the fresh surface of the profile.

In a preferred embodiment, a sol-gel precursor supplied by company Akzo Nobel under brand name CERA-PAINT is used to form the corrosion protection layer.

Another purpose of the present invention is providing an aluminium alloy extruded profile part which could have been coated by the coating process step according to the invention, i.e. which is characterised in that it has a corrosion-resistant layer directly deposited on the aluminium alloy of the said extruded profile, except at its sawn ends. The said extruded profile is advantageously made of any of the following alloys: AA 6005, AA 6005A, AA 6008, AA 6014, AA 6060, AA 6061, AA 6063, AA 6063A, AA 6056, AA 6066, AA 6082, AA 6101, AA 6110, AA 6110A, AA 6182, AA 6401 and AA 6463. Preferably, the said corrosion-resistant layer results from the application of a sol-gel precursor and comprises an inorganic network of polysiloxanes affiliated with alkyl groups attached to the said inorganic network with carbon bonds.

Such profiles have a cosmetic corrosion resistance better than uncoated profiles but they do not have to comply with any particularly demanding requirement related to their aesthetic aspect such as profiles for the building industry. Such profiles are preferably structural profiles extruded from an AA6xxx aluminium alloy and heat treated to tempers T6 or T5.

Figure 1 illustrates schematically a conventional extrusion process scheme.

Figure 2 illustrates schematically the scheme of the extrusion process according to the invention.

EXAMPLE 1: Definition of an appropriate sol-gel precursor

Laboratory experiments (batch tests) were made on extruded profiles coated with several types of sol-gel precursors.

- water based sol-gel systems, among them a sol-gel precursor supplied by company Evonik-Degussa with the trademark Dynasylan® Sivo 110
- alcohol based sol-gel systems, among them a sol-gel precursor supplied by company Akzo Nobel with the trademark Cerapaint®

The different sol-gel precursor solutions were sprayed using a spray gun the nozzle of which had a diameter of 1.3 mm. The distance between the spray gun and the substrate, the pressure of the air and the dilution of the lacquer are parameters which can be adapted to change the thickness and the appearance of the coatings. Spray coatings were realised on substrates at room temperature and also on substrates pre-heated at 180°C and 230°C. The reference of
the spray gun, which was used, is Sata RP 2000.

[0035] Water-based sol-gel precursors were less easy to be sprayed and to form a regular coating with a smooth surface, whatever the surface temperature of the substrate and consequently gave bad results in the corrosion tests. Therefore, although their autoignition temperature is lower and their shelf-life is shorter, alcohol based sol-gel systems have been preferred: they were easier to be sprayed and presented a lower risk of contamination of the line.

[0036] Finally, the sol-gel precursor chosen for the in-line experiments (See example 3) is an alcohol based sol-gel system, which is prepared by acid catalyzed hydrolysis and condensation of a mixture of a water-free solution A and an aqueous solution B, where the solution A is a solution comprising 30 wt% tetraethoxysilan (TEOS), 20 wt% methyl trimethoxysilane (MTMOS) and 50 wt% isopropyl alcohol. Solution B is a suspension of 25% colloidal silica in 75 wt% deionised water acidified to a pH of 2.7 by nitric acid.

[0037] To a basic solution A as described above, in a proportion of 70 wt% of the mixed solution, is added, under mechanical agitation, the solution B in a proportion of 30 wt% of the mixed solution. The pH of the mixed solution is adjusted by means of nitric acid to a value of 2.7. The mixed solution is agitated for around 6 hours, whereby reaction-induced heat is released, and then filtered using a polypropylene filter with pore size of 1 μm. After filtering the residue is discarded and the filtrate is allowed to rest for a period between 12 and 22 hours before being applied to the substrate to form the protective coating.

[0038] A solution prepared in this manner has a room temperature dynamic viscosity below 20 cP (i.e. 2 × 10⁻² Pa.s or Nm⁻² s⁻¹) and is suitable for spray application by the equipment described above.

[0039] This coating precursor used for the in-line experiments (See example 3) is also characterized in that no harmful component is released during the formation of the protective layer.

[0040] We have also noted that coatings obtained on substrates at 180°C were more regular and therefore gave better corrosion results than coatings obtained on substrates at 230°C.

EXAMPLE 2: CONVENTIONAL EXTRUSION LINE (FIGURE 1)

[0041] Figure 1 illustrates schematically a conventional extrusion line, where aluminium logs are supplied by the log loader (10) and driven to the preheating oven (20). The logs are sheared with a heat shearing device (25) at the exit of the preheating oven to obtain billets at the desired length. In an alternative process, the cold logs are sawed to make billets at the wished length which are then preheated, by generally using an induction furnace. The hot billet is then driven towards the extrusion press (30): it is introduced into the central bore of the container (32) thanks to the mandrel (33) attached to the piston (34) which moves towards the press platen (31), where the die set is located. Once the billet is inside the container and abuts against the die surface, the extrusion starts by moving forward the piston and an extruded profile exits from the die hole.

[0042] Once the end of the profile, which initially exits from the die, is out of the extrusion press, the latter is caught by the puller (42), which draws the profile (100) during the entire extrusion step with a speed adapted to the speed of the profile so that the profile remains straight and slightly stretched up to the run out table (50). At the end of the extrusion step, the piston (34) is stopped; the container (32) is removed from the die set so that the butt can be sheared. After the butt is sheared, the final end of the profile is released and the profile can then be drawn again by the puller until that it is fully located on the run out table.

[0043] In particular for heat treatable alloy profiles, a cooling device (41) is used to quench the profile at the exit of the extrusion press. Once on the run out table, the profile is generally slightly plasticly stretched by a stretcher (60) and then sawn at the wished length by a sawing machine (70). The profile parts (110) thus obtained are then stacked in a storage area (80) and heat treated, generally in ageing ovens (90).

EXAMPLE 3: SPRAYING A SOL-GEL LACQUER AT THE EXIT OF THE EXTRUSION PRESS (FIGURE 2)

[0044] The extrusion line used in this example is close to the extrusion line described in example 2. The main difference with the conventional extrusion line lies in that a spraying device (45) is introduced at the exit of the extrusion press, downwards of the quenching device (41) and upwards the run out table (50).

[0045] The profile extruded is a tubular profile having an approximately square section of 80mm*80 mm with 2 mm thick walls. It is extruded from a billet in AA6063 through a porthole die with an exit speed of approximately 30 m/min. The profile is quenched with forced air by the quenching device which is several meters long and begins around 1 meter from the exit of the extrusion die. The temperature of the metal after air quenching is around 180°C.

[0046] The spraying device is located downwards of the quenching device, typically in an area distant of approximately 6-8 meters from the last end of the bearings. In the present case, it comprises 4 spray guns.

[0047] The section of the profile used for this test has a quite high size. Smaller extruded profiles, exiting simultaneously from the extrusion press, could also be coated using this spraying device, provided that they are guided to have a stabilised course in the spraying area, which is quite easy to do since this area is far enough from the die exits. The
number and the location of the spray guns should be adapted to their shape and spatial configuration. Larger sections could also be coated in a similar way on a larger press.

[0048] The spraying device (45) works in coordination with the puller (42) in such a manner that there is no coating accumulation when the extrusion press is stopped for shearing the butt.

CORROSION TESTS

[0049] Two types of corrosion tests were applied on the thus coated profiles and on anodised and untreated profiles for comparison.

A- Neutral salt spray test (acc. to SN EN ISO 9227 NSS)

[0050]

Sample preparation: The coating of each variant has been scribed with a double St. Andrew’s cross down to the base metal using a cutting tool according to ISO 2409.
Test chamber: Erichsen, Type 606, 1000 Liter
Sample orientation: ca. 15 — 25° inclination
Test temperature: 35±2°C
Test solution: Neutral, (5±0.5)% sodium chloride (NaCl) solution with pH 6.5 — 7.2
The test is terminated after 1000 hours. Intermediate assessments were done after 240 and 500h
Assessments:
- Assessment for any corrosion creep or blistering at St. Andrew’s cross
- Assessment of the surface free of scribes for blistering according to DIN EN ISO 4628-2 and for pitting corrosion according to ISO 8993

Results:

[0051] Sol gel coated and anodised profiles do not show any corrosion attack. Untreated profiles are strongly corroded already after 240h.

2 - QUV-B test (according to ASTM G-154-06)

[0052]

Test cycles:
- 4 hours subsequent irradiation
- 4 hours condensation in the dark

Temperature:
- during irradiation: 60°C,
- during condensation: 50°C

Irradiation source: UVB 313 lamp
The test was terminated after 500 hours, intermediate assessment was realised after 240h.
Assessment: Visual assessment

Results:

[0053] Sol gel coated profiles do not suffer any corrosion. Anodised and untreated profiles are corroded after 240h. The anodisation layer is degraded because of the condensation cycles during the QUV-B testing and not directly because of the QUV irradiation.

[0054] The hot profiles coated with the sol-gel precursor and cured afterwards at high temperature currently used for the ageing of the profiles showed a much better corrosion resistance than uncoated profiles.
Claims

1. Process for manufacturing aluminium alloy extruded profile parts which are resistant to corrosion, comprising the following steps:
   a) providing a billet in the said aluminium alloy at a temperature suitable for the extrusion;
   b) extruding the billet through a die to create at least one profile having the desired shape and length and optionally cooling or quenching the profile after the exit of the die;
   c) optionally stretching the profile, to obtain a plastic deformation typically below about 1 %;
   d) sawing the extruded profile to obtain profile parts at the desired length;
   characterised in that during step b) a corrosion-resistant layer is coated on the surface of the profile by depositing a fluid solution on the freshly formed metal surface exiting from the extrusion press, the resulting coating becoming then, by evaporation and/or curing and/or any other physical or chemical transformation, the said corrosion-resistant layer.

2. Process according to claim 1, characterised in that a depositing device is used for depositing the said fluid solution, the said depositing device being located near the exit of the extrusion press, preferably downstream of the quenching workstation used in step b), if any, and upstream of the sawing device used in step d), preferably upstream of the run out table.

3. Process according to claim 1 or 2, wherein, during step b), the extruded profile is caught by a puller (42), which draws the said profile during the entire extrusion step with a speed adapted to the speed of the profile so that the profile remains straight, characterised in that the depositing device works in coordination with the puller in such a manner that there is no coating accumulation when the extrusion press is stopped for shearing the butt.

4. Process according to any one of claims 1 to 3, characterised in that the fluid solution is deposited on the said fresh metal surface by spraying.

5. Process according to any one of claims 1 to 4, wherein the said fluid solution contains a flammable component, characterised in that, at the end of step b), the profile is quenched to a temperature less than the autoignition temperature of the flammable material.

6. Process according to any one of claims 1 to 5, characterised in that the said fluid solution is a sol-gel precursor.

7. Process according to claim 6, wherein the profile is quenched to a temperature between 80 °C and 250 °C, preferably between 140 °C and 210 °C, more preferably between 150 °C and 200°C.

8. Process according to any one of claims 6 to 7, characterised in that the sol-gel precursor is made from mixing a polysiloxane, preferably prepared from an alcoholic silane solution, especially an alkoxysilane solution, and an aqueous colloidal silica solution.

9. Process according to any one of claims 6 to 8, characterised in that the sol-gel precursor is prepared from two basic solutions A and B, wherein:
   a) solution A is an alcoholic solution of one or more different alkoxysilanes, the alcohol used as a solvent, being methyl, ethyl, propyl, or butyl alcohol or, preferably, isopropyl alcohol., the alkoxysilanes being described by the general formula $X_nSi(OR)_{4-n}$ in which "R" is a simple alkyl, preferably from the group comprising methyl, ethyl, propyl and butyl and "X" is also an alkyl, preferably from the group comprising methyl, ethyl, propyl and butyl.
   b) solution B is colloidal silica dissolved in water.

10. Process according to claim 9, wherein said alkoxysilanes belong to the group comprising tetramethoxysilane (TMOS), tetraethoxysilane (TEOS) and methyl trimethoxysilane (MTMOS).

11. Process according to claim 10, wherein the solution A contains 25 - 35 wt% TEOS and 15 - 25 wt% MTMOS, both dissolved in 40 - 60 wt% isopropyl alcohol.

12. Process according to any of claims 9 to 11, wherein solution B is set with an acid, preferably with nitric acid (HNO₃),
to a pH value between 2.0 and 4, preferably between 2.5 and 3.0 and more preferably close to 2.7.

13. Process according to any of claims 8 to 12, wherein the alkali content of the silica is less than 0.04 wt % Na₂O.

14. Aluminium alloy extruded profile part characterised in that it has a corrosion-resistant layer directly deposited on the aluminium alloy of the said extruded profile, except at its sawn ends.

15. Aluminium alloy extruded profile part according to claim 13, characterised in that it is made of any of the following alloys: AA 6005, AA 6005A, AA 6008, AA 6014, AA 6060, AA 6061, AA 6063, AA 6063A, AA 6056, AA 6066, AA 6082, AA 6101, AA 6110, AA 6110A, AA 6182, AA 6401 and AA 6463.

16. Aluminium alloy extruded profile part according to claim 13 or 14, characterised in that the said corrosion-resistant layer comprises an inorganic network of polysiloxanes affiliated with alkyl groups attached to the said inorganic network with carbon bonds.
Figure 1 (prior art)

Fig. 2
# European Search Report

**Application Number**: EP 11 00 1244

**DOCTMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
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The present search report has been drawn up for all claims

**Place of search**: Munich

**Date of completion of the search**: 7 July 2011

**Examiner**: Ritter, Florian

**CATEGORY OF CITED DOCUMENTS**

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For more details about this annex: see Official Journal of the European Patent Office, No. 13/82.
REFERENCES CITED IN THE DESCRIPTION

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