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(54) **Process for cleaning and conditioning the surface of an electrolytically oxidizable metal alloy by hyperanodizing said surface**

Verfahren zum Reinigen und Konditionieren der Oberfläche elektrolytisch oxidierbarer Metalle oder Legierungen durch Hyperanodisieren

Procédé de nettoyage et conditionnement de la surface d'un métal ou alliage électrolytiquement oxydable par hyperanodisation de cette surface

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Description

[0001] According to the present state of the art, the washing process commonly used by aluminum alloy manufacturers or fabricators essentially consists in a band degreasing step carried out in order to remove greases or similar organic substances used in the rolling process.

[0002] Such a removal is carried out by bringing the band to be washed into contact with a liquid phase displaying strong affinity for the impurities, substantially performing the task of transferring the latter from the solid into the liquid phase.

[0003] Said processes are usually carried out with solvent liquids (e.g., trichloroethylene) or alkaline solutions which are suitably buffered, therefore with reduced reactivity towards aluminum; in order to cause the impurities to diffuse, the processes known from the prior art rely on diffusion (high-temperature processes), or on kinds of fluxing (castings), or on the supply of mechanical energy to the interface (brushing, sonication).

[0004] A rinsing step follows, often followed, in its turn, by steps of anchoring functional groups for surface protection, or acting as adhesion promoters (oxidation, chromate treatment, phosphating treatment or phospho-chromate treatment).

[0005] In order to be effective, these processes require a long enough surface-liquid contact time as to make it possible material to diffuse between the metal, the limit layer, and the liquid, which time, when bands are submitted to such a continuous, high-speed treatment, may require that considerably long facilities are used, with consequent large overall dimensions and high costs; furthermore, the use of hydrogenated rolling lubricants, such as, e.g., lauryl alcohol, and the like, having electronic affinity for aluminum, compromises the transfer of impurities to the liquid phase, sometimes rendering necessary a preliminary chemical etching step prior to the subsequent treatments, with problems of disposal of the resulting waste products consequently arising.

[0006] Electrochemical processes are known as well in the practice of metal articles degreasing, which consist in submitting the metal surface to an anodic or cathodic action, while said surface is immersed in suitable electrolytic solutions.

[0007] This practice, useful in order to activate the surface as a preliminary step to electrodepositions is, unfortunately, ineffective for degreasing purposes, because the flow of the ionic species, and of the released gases does not interact with the presence of grease or oleol impurities.

[0008] Due to such a reason, in the practical operations of facilities for continuous band degreasing, this solution is not applied. SU 12 44 216 describes the electrochemical treatment in washing solution used as electrolyte, in which the electrolyte is hexametaphosphate (salt of a weak acid), which means that an alkaline pH is involved.

[0009] The process according to the present patent application consists in an action of ionic type which exclusively occurs at high current density values (superficial electrical intensity comprised within the range of from some tens, up to one hundred A/dm^2), in the presence of a polybasic acidic electrolyte, when the electrolytically oxidizable material is submitted 5 to anodizing with a higher voltage than the stopping potential of formed oxide.

[0010] More specifically, the present invention consists of a process for cleaning and conditioning the surface of an electrolitically oxidisable metal alloy, in which said alloy is immersed in a solution of an electrolyte and said surface of said alloy is submitted to anodising, characterised by the fact that said alloy is a light alloy, said electrolyte is a polybasic acidic electrolyte and that an oxide layer is formed on said surface, the anodising voltage being higher than the breakdown potential of said oxide layer.

[0011] Under such conditions, a sharp potential decrease takes place on that Layer which is the nearest to the metal, with unstable ionic species (radicals) being 10 generated, which are capable of destroying the degradable organic substances, or of reducing their affinity for the metal.

[0012] In other terms, the voltage gradient, concentrated in the immediate nearby of the surface of 15 the metal to be treated, promotes a violent, localized energy development with the results disclosed hereinabove being accomplished.

[0013] A process results which is governed by easily modulated electrical parameters in which, following a supply of electrical energy (of the order of 1 kW/dm^2 of exposed surface) a nearly immediate decontamination of band surface is attained.

[0014] Therefore, the essential parameters are constituted by the electrical conductivity of the bath 25 and the local current density on the surface to be treated.

[0015] The present electrodes, necessary for the above events to take place prevailingly perform transport functions, and therefore their composition slowly 30 varies during the process.

[0016] In practical tests, several low-concentration (2 ÷ 5 %) acidic electrolytes were successfully tested under moderately high temperature (80 ÷ 90°C) conditions.

[0017] In order to maintain the temperature level, the energy excess turned into heat must be transferred to a secondary fluid, and can be recovered for the rinsing or drying process.

[0018] From a practical viewpoint, the band to be treated is electrically connected to the positive terminal of power supply unit.

[0019] The ionic action takes place inside a tank inside which the band can run while being immersed, exposed to the surfaces of opposite polarity electrodes (cathodes).

[0020] Current flow is so controlled as to keep constant energy developed at band surface, correlating it, e.g., to the running speed of said band.
In other words the process consists in submitting the surface layer of an electrolytically oxidizable light alloy to the action of an electrical field with a higher field intensity than the breakdown intensity during an anodizing step.
[0021] Under such conditions, extremely intense energy exchanges occur in a region confined on the surface of the immersed article; the resulting physical and chemical processes cause, among others, any impurities to be nearly immediately removed, and a useful surface conditioning layer for subsequent processes to be produced.
[0022] The process is particularly useful for high-speed treatment of bands of light alloy.

Claims

1. Process for cleaning and conditioning the surface of an electrolytically oxidisable metal alloy, in which said alloy is immersed in a solution of an electrolyte and said surface of said alloy is submitted to anodising, characterised by the fact that said alloy is a light alloy, said electrolyte is a polybasic acidic electrolyte and that an oxide layer is formed on said surface, the anodising voltage being higher than the breakdown potential of said oxide layer.

2. Process according to claim 1, characterised in that said electrolyte is phosphoric acid.

3. Process according to claim 1, characterised in that concentrations of from 1 to 6%, by weight, of said electrolyte are used.

4. Process according to claim 1, characterised in that said process is carried out at a temperature within the range of from 50 to 100°C.

5. Process according to claim 1, characterised by the fact that said alloy is a light alloy band.

Patentansprüche

1. Verfahren zur Reinigung und Konditionierung der Oberfläche einer/eines elektrolytisch oxidierbaren Metalls/Legierung, bei dem das/die Metall/Legierung In eine Elektrolytlösung getaucht und die Oberfläche des/der Metall/Legierung anodisiert wird,
dadurch **gekennzeichnet**, daß das/die Metall/Legierung ein(e) Leichtmetall (Leichtmetallegierung) ist, der Elektrolyt ein polybasischer saurer Elektrolyt ist und daß eine Oxidschicht auf der Oberfläche gebildet wird, wobei die Anodisierungsspannung höher ist als das Durchschlagspotential dieser Oxidschicht.

2. Verfahren nach Anspruch 1,
dadurch **gekennzeichnet**, daß als Elektrolyt Phosphorsäure eingesetzt wird.

3. Verfahren nach Anspruch 1,
dadurch **gekennzeichnet**, daß der Elektrolyt in einer Konzentration von 1 bis 6 Gew.-% eingesetzt wird.

4. Verfahren nach Anspruch 1,
dadurch **gekennzeichnet**, daß das Verfahren bei einer Temperatur von 50 bis 100° C durchgeführt wird.

5. Verfahren nach Anspruch 1,
dadurch **gekennzeichnet**, daß es sich bei dem Metall/der Metallegierung um ein Leichtmetallband/Leichtmetallegierungsband handelt.

Revendications

1. Procédé de nettoyage et de conditionnement de la surface d'un alliage métallique oxydable électrolytiquement, dans lequel cet alliage est immergé dans une solution d'un électrolyte et la surface de l'alliage est soumise à une anodisation, caractérisé par le fait que l'alliage est un alliage léger, en ce que l'électrolyte est un électrolyte acide polybasique, et en ce qu'une couche d'oxyde est formée sur la surface, la tension d'anodisation étant supérieure au potentiel de rupture de la couche d'oxyde.

2. Procédé selon la revendication 1, caractérisé en ce que l'électrolyte est de l'acide phosphorique.

3. Procédé selon la revendication 1, caractérisé en ce que des concentrations allant de 1 à 6 % en poids d'électrolyte sont utilisées.

4. Procédé selon la revendication 1, caractérisé en ce que le procédé est mis en oeuvre à une température située dans la plage comprise entre 50 et 100°C.

5. Procédé selon la revendication 1, caractérisé par le fait que l'alliage est une bande d'alliage léger.